
INTERNATIONAL TRADE AND INCOME INEQUALITY:
THE CASE OF LATIN AMERICAN COUNTRIES

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Abstract

The main goal of this dissertation is to analyse the impact of international trade on income inequality in Latin American countries between 1997-2016. Latin America shows one of the highest levels of income inequality in the world although observing a declining trend in recent years. International trade presents increasing importance for the economic growth in this region with recent changes in the external policy in most countries. Using mostly the Heckscher-Ohlin-Samuelson model as a framework, studies suggest that an intensification in international trade may have different results over income inequality according to the specificities of the openness process. To the best of our knowledge, there are very few studies on the effects of trade structure on income inequality and none for Latin America and this study aims to fill this gap. This study estimates a multivariate regression model using panel data for 14 countries in Latin America for the period from 1997 to 2016. The dependent variable is income inequality (Gini index and Kuznets ratio) and as explanatory variables we consider trade openness, economic complexity, terms of trade, and natural resources rents, besides other control variables. Our results suggest that international trade variables such as trade openness, economic complexity and terms of trade are highly significant and has impacted the income distribution in Latin America. The results show that the “simplification” (as opposed to complexification) of the economy, following the process of trade openness, led to a reduction in income inequality in the region. Aiming not to restrict such an improvement in the short term, this research seeks to contribute to the elaboration of smart policies to take advantage of comparative advantages, benefiting the long-term development of Latin America.

JEL-codes: F15; O15; C33.

Keywords: International trade; Trade openness; Trade structure; Income inequality; Latin America.

Resumo

O objetivo principal desta dissertação é analisar o impacto do comércio internacional sobre a desigualdade de rendimento nos países latino-americanos entre 1997-2016. A América Latina apresenta um dos maiores níveis de desigualdade de rendimento do mundo, embora observe uma tendência decrescente nos últimos anos. Verifica-se ainda que o comércio internacional apresenta uma importância crescente para o crescimento económico nessa região, com mudanças recentes na política externa na maioria dos países. Tendo como referência principal o modelo de Heckscher-Ohlin-Samuelson, a literatura sugere que uma intensificação no comércio internacional pode resultar num aumento ou numa diminuição da desigualdade de rendimento de acordo com as especificidades do processo de abertura. Tanto quanto é do nosso conhecimento, existem poucos estudos sobre os efeitos da estrutura do comércio sobre a desigualdade de renda e nenhum para a América Latina, e este estudo visa preencher essa lacuna. Este estudo estima um modelo de regressão multivariado recorrendo a dados de painel para 14 países da América Latina no período de 1997 a 2016. A variável dependente é a desigualdade de renda (índice Gini e Kuznets ratio) e como variáveis explicativas consideramos abertura ao comércio, complexidade económica, termos de troca e rendas de recursos naturais, além de outras variáveis de controlo. Os nossos resultados sugerem que as variáveis do comércio internacional, como abertura ao comércio, complexidade económica e termos de troca, são altamente significativas e influenciaram a distribuição de rendimento na América Latina. Os resultados mostram ainda que a “simplificação” (ao contrário da complexificação) da economia, seguindo o processo de abertura ao comércio, levou a uma redução da desigualdade de rendimento na região. Esta pesquisa pretende contribuir para a elaboração de políticas inteligentes para aproveitar as vantagens comparativas, beneficiando o desenvolvimento de longo prazo da América Latina.

Códigos-JEL: F15; O15; C33.

Palavras-chave: Comércio internacional; Abertura ao comércio; Estrutura de comércio; Desigualdade de rendimento; América Latina.

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Chapter 1. Introduction

According to Jaumotte *et al.* (2013), during the last decades, globalization – specifically of trade – has grown significantly and is widely regarded as one of the main drivers for global economic growth. However, the impact of the increase in trade flows in the well-being of populations and in particular, over income disparities within countries is a controversial subject in the economic literature. The evidence suggests that an increase in international trade may have different results over income inequality according to the country's trade and economic structure and to the degree and specificities of the openness process (*e.g.* Anderson, 2005; Hartmann *et al.*, 2017).

At this purpose, Hellier & Chusseau (2012) state that, as regards the effect of trade openness upon inequality, the Heckscher-Ohlin-Samuelson (HOS) model predicts a decrease in inequality in developing countries when trade openness is implemented. The theorem argues that there will be an increase in the real reward of the factor used intensively in the export sector and a reduction in the real reward of the factor used intensively in the import sector. Thus, according to Meschi & Vivarelli (2009), in the context of developing countries, which are low-skilled-labour abundant, international trade should raise the prices for this kind of labour force, provoking a more even wage distribution.

Hellier & Chusseau (2012) contrast the Heckscher-Ohlin-Samuelson model with the Kuznets's hypothesis that suggests that countries in intermediary stages of economic development would have higher levels of inequality. As a consequence, inequality should increase in the initial stages of development, due to the enlargement of the modern sector and the increase in exports (as a result of change in the economy's orientation from autarchy to international trade).¹ However, according to Todaro & Smith (2012), recent empirical studies complement Kuznets's hypothesis suggesting that under certain conditions the relationship between inequality and economic growth may follow a different path.

Also, recent empirical studies seek to further explore the implications of trade over income inequality, focusing on the impacts of openness and trade structure on inequality. According to Anderson (2005), three different hypotheses can be drawn to distinguish the effects of openness over income inequality: (i) increases inequality in all countries; (ii)

¹ The leading author of structural change was Sir W. Arthur Lewis, to be explored in the next chapter. The Lewis model suggests that economic growth occurs as a consequence of an increase of the modern industrial and export sector and a decrease in the size of the traditional agricultural subsistence sector.

decreases in developing countries, but rises in developed countries, and (iii) has a diverse effect according to the factor endowments of countries. The existing literature shows no conclusive empirical findings on the effects of openness on inequality. Focusing on the influence of trade structure on inequality, and using the Economic Complexity Index (ECI) to assess the degree of sophistication of a countries' productive structure, Hartmann *et al.* (2017) concluded that complex products exporters have lower levels of income inequality if compared with simple products exporters.

In the particular case of Latin American countries, Hellier & Chusseau (2012) claim that Latin America tends to contradict the predictions of the HOS theory, as trade openness has a negative effect over income inequality. The authors mention the work of Pagés & Márquez (1998) for Latin America and the Caribbean and Green *et al.* (2001) for Brazil that sustain this statement. However, studies analysing more recent data show that there has been a reduction in inequality in the region at least since the 2000s. According to the literature (*e.g.* Bresser-Pereira, 2008; De La Torre *et al.*, 2017; Messina & Silva, 2017; Guerra-Salas, 2018), some of the Latin American countries witnessed Dutch disease² effects that may have led to the fall in inequality due to changes in the labour market.

Understanding the links between international trade and income inequality is the main purpose of this investigation. More specifically, this research seeks to investigate if trade flows and trade structure influence income inequality in Latin American countries. The central questions to answer are the following: what are the evidences concerning trade structure and income inequality in Latin American? What is the relation between openness and income inequality? Is the complexity of exports relevant for inequality reduction?

This research focuses on Latin America for several motives. Firstly, despite being one of the most unequal regions in the world,³ it presented a significant reduction of its economic disparities in the 2000s.⁴ Aiming not to restrict such an improvement in the short term, this research seeks to contribute to the elaboration of smart policies to take advantage

² According to Nafziger (2006; p.418), Dutch disease is the process through which “growth in the booming export sector reduces the price of foreign exchange, retarding other sectors’ growth by reducing incentives to export other commodities and replace domestic goods for imports and raising factor and input prices for non-booming sectors.”

³ Out of the 30 most unequal countries – on ranking using the GINI coefficient, developed by the Central Intelligence Agency – 13 are Latin American. Data is available at <https://www.cia.gov/library/publications>. Accessed on August 15, 2018.

⁴ Data on income inequality (Gini index) is available on an annual basis and is constructed by the World Development Indicators (WDI), World Bank. Available at <https://data.worldbank.org/indicator/>, accessed on November 24, 2018.

of comparative advantages, benefiting the long-term development of Latin America. Also, the region presented in the past decades important shifts in the external trade policy for most of its countries, which have not been yet sufficiently explored in academic studies – to the best of our knowledge, no study focuses exclusively on the connection between trade structure and income inequality for the region. In addition to that, the increasing relevance of the international trade for the region⁵ and the importance of controlling income inequality for social and political stability demonstrates the importance of understanding the relationship between international trade and income inequality in Latin America – research field which, to the best of our knowledge, is still scarcely explored by scientific studies and for which we intend to contribute through this work – both academically and for policy-making purposes.

This study uses a multivariate econometric model to empirically assess the effects of international trade over income inequality. This methodology is the standard choice for researches conducting similar quantitative empirical studies (Annex 1 details, among other information, the research methods used for the most relevant studies mentioned throughout this dissertation). We use a panel data for 14 countries in Latin America for the period from 1997 to 2016. The dependent variable is income inequality and we use trade indicators as explanatory variables, besides other control variables considered in the literature.

The dissertation is organized as follows. Next chapter is devoted to a brief exposition on the role of international trade and income inequality in economic science. Afterward, in Chapters 3 and 4 we proceed through economic modelling to study the impact of international trade on income inequality for Latin American countries. Subsequently, we end with some final remarks and future research paths.

⁵ The value of merchandise exports for the region went from US\$ 158 billion in 1990 – which represented only 23% of the region's GDP – to US\$ 1.2 trillion, reaching almost 37% of the region's GDP in 2011. Data for Merchandise Exports (current US\$) and for Merchandise trade (% of GDP) is available at <https://data.worldbank.org/indicator>. Accessed on November 28, 2018.

Chapter 2. Inequality and trade: main insights from the literature

This chapter summarizes the main contributions in the economic literature related to international trade and income inequality. The first section discusses the concepts and measures of inequality. Thereafter, we seek to analyse the determinants of inequality, focusing on structural change and international trade approaches. From the fourth section onwards we explore empirical studies of authors whose work contribute to the understanding of the relationship between trade and income distribution, both globally and in the specific case of Latin America.

2.1 Inequality: concepts and measures

According to Todaro & Smith (2012), income distribution can be essentially characterized in two fundamental ways: personal or functional.⁶ Functional – also known as factor share distribution of income – considers the share of total national income that each of the factors of production receives (through wages, profits or rents). Personal – or size distribution of income – is most commonly utilized by economists (also, is the one considered in this study) and reflects the income received by individual or households, regardless of the factor through which the income is acquired.

In order to measure income inequality, economists group individuals according to their income. According to Todaro & Smith (2012), a popular method is to divide the population into five (quintiles) or ten (deciles) groups and then calculate the proportion of the national income received by each of these groups. Quintiles and deciles can be compared to each other in order to show how income is distributed within a country. A popular comparison between them can be expressed by the Kuznets ratio, which is a measure derived from the quintiles. This specific ratio compares income received by the top 20% and the bottom 40% of the population.

⁶ It is worth distinguishing income inequality from poverty. Poverty is defined as the situation of individuals being below a threshold of income or consumption. According to Nafziger (2006), absolute poverty is the condition in which someone has insufficient income to meet basic needs such as food, shelter, and clothing. Poverty can also be measured through a relative line (*e.g.* 60% of the median income of a country) below which individuals are considered poor. Nafziger (2006; p.179) defends that the discussion on income inequality “is not limited to the income distribution of the poor but focuses on the overall income concentration among both nonpoor and poor.”

According to Thirlwall (2011), the most common measure of income inequality is the Gini index. The author explains that it can be derived from the Lorenz curve, which, in turn, can be defined as a chart describing the difference of the actual income distribution in a given country and a perfect equality distribution. The Gini index is obtained by dividing the area between the line of perfect equality (45-degree line) and the Lorenz curve and the total area of the half-square used in the model. The index ranges from 0 (perfect equality) to 100 (perfect inequality).⁷ Todaro & Smith (2012; p.208) defined the Gini index as an: “aggregate numerical measure of income inequality ranging from 0 (perfect equality) to 100 (perfect inequality).”⁸

2.2 Determinants of inequality

In this section the determinants of inequality are analysed, from the structural change variables into other variables describing the labour market and institutional determinants. In the next section, special attention will be given to international trade, which is the focus of our work. This presentation will guide our choice for some of the control variables used in the model’s estimation.

Growth and structural change

Several economists developed theoretical and empirical analyses on the relationship between economic development and income distribution. Simon Kuznets, publishing mostly between the fifties and seventies of the last century, is the foremost author. Kuznets (1955) suggested an inverted “U-shaped” curve to describe the relationship between a country’s income and its level of inequality. The Kuznets’ curve, as it is known, shows that countries in both earlier and advanced stages of economic development would have a lower level of inequality, while countries in intermediary stages would have higher levels.

⁷ The literature uses both the term coefficient and index, the former ranging from 0 to 1 and the second from 0 to 100.

⁸ According to Todaro & Smith (2012; p.209), “the Gini coefficient is among a class of measures that satisfy four highly desirable properties: the anonymity, scale independence, population independence, and transfer principles. The anonymity principle simply means that our measure of inequality should not depend on who has the higher income. The scale independence principle means that our measure of inequality should not depend on the size of the economy or the way we measure its income. The population independence principle is somewhat similar; it states that the measure of inequality should not be based on the number of income recipients. Finally, we have the transfer principle, it states that, holding all other incomes constant, if we transfer some income from a richer person to a poorer person (but not so much that the poorer person is now richer than the originally rich person), the resulting new income distribution is more equal.”

There are several explanations for Kuznets's empirical findings. Generally, they seek to explain the increase in inequality in the initial phases of economic growth through the process of structural change. The leading author of structural change was Sir W. Arthur Lewis. The Lewis model suggests that economic growth occurs as a consequence of an increase of the modern industrial sector and a decrease in the size of the traditional agricultural sector. According to the model, this process will happen due to an unlimited supply of surplus labour from traditional sector, which is possible due to a premium over subsistence wage, and capital accumulation in the modern sector. Although references generally oppose agriculture to industry, the modern sector also contains modern agriculture and mining activities (which is an important consideration in the Latin American case). Another important feature of the modern sector is that production can be exported, while in the traditional sector it is primarily oriented for subsistence.

According to Adelman & Morris (1973) (*cf.* Nafziger, 2006), within a dual economy, the expansion of the modern sector and the shrinkage of the traditional sector will bring both economic and inequality growth. This might be a consequence of the fact that both income and productivity in the modern sector are considerably superior to the same indicators within the traditional sector.

However, later empirical studies contradict Kuznets' hypothesis. According to Fields (1987), economic growth can occur in three different ways: through (i) enrichment of the high-income sector, (ii) enrichment of the low-income sector or (iii) enlargement of the high-income sector (*i.e.* expansion and incorporation of people previously in the low-income sector). The author suggests that special attention should be given to the third type of economic growth since the results are inconsistent with the Kuznets' hypothesis. Thus, the author refutes the hypothesis that inequality would necessarily increase following the first stages of economic growth – this would depend on the number of individuals within each income category (high-income and low-income sectors).

In the same line of reasoning, Todaro & Smith (2012) state that the empirical validity of the Kuznet's hypothesis depends on the type of study: while cross-sectional studies tend to support the inverted "U-shaped" hypothesis (even though data exhibits lots of variation), time series analysis tend to offer evidences both of a direct U shaped and inverse U relationship. In addition, there are numerous examples of countries – such as South Korea, Sri Lanka, Taiwan, and Costa Rica – showing that higher income levels can be accompanied by

decreasing of inequality. Todaro & Smith (2012) argue that the characteristics of the development process are defining and cannot be disregarded.

Labour Market

According to Sen (1973), unemployment is closely connected with inequality. Since wage is considered one of the main sources of income, its absence should contribute to an increase in poverty and, possibly, inequality. However, as demonstrated by Checchi & García-Peñalosa (2008), labour market institutions may also have a role. In economies where high unemployment benefits exist, it may lead to an increase in wage share and inequality reduction. For the case of Latin American countries, Messina & Silva (2017) suggest that unemployment contributes to inequality increase.

According to Acemoglu (1999), differences in wage also impacts income distribution.⁹ In this regard, the minimum wage is an important variable to be considered. As suggested by Duryea *et al.* (2017), although intuitively the increase in the minimum wage should lead to a reduction of inequality (by bringing relatively more earnings to people with lower wages), it might also impact it in the opposite direction. As higher minimum wages raise the labour costs, it may lead to higher unemployment, especially in low growth economies.

Education

Education and schooling are associated with income inequality. According to Nafziger (2006), large investments in primary education should contribute to a reduction in income inequality. Clarke (1995) states that if in one hand public expenditures on primary education tend to reallocate income toward the poorest, in the other hand, such spending on secondary and higher education tend to concentrate income in the richest sector. The author suggests that poor people tend to have bigger families and virtually no access to private education, thus, public expenditures should allow these children to access school. However, as it is harder for poor children to remain for long periods in school, public investment in higher education tend to benefit relatively more the rich.

⁹ We must note that wage is an important variable to control for functional inequality, explained by the Heckscher-Ohlin-Samuelson mechanism, detailed in the next section of this study.

Institutions

Finally, the degree of inclusiveness of institutions may be determinant to define the level of inequality. According to Engerman & Sokoloff (1997), a country's productive structures evolve together with the inclusiveness of its institutions. Thus, differences in income might be attributed to the quality of the institutions present in a given country. Building on this idea, Hartmann *et al.* (2017) state that better income distribution is due to three mechanisms present in more complex economies. First, learning opportunities and worker's bargaining power are greater in more complex economies, encouraging the emergence of a middle class and constant learning. Secondly, both education and social capital favour the development of healthy institutions. Third, a consequence of having a diversity of healthy institutions is a reduced probability of these institutions being captured by political power.

2.3 On the mechanisms of International Trade and Inequality

The concept of comparative advantage was introduced by David Ricardo in 1817 and seeks to explain how the exchange of products can potentially benefit all countries engaged in trade activities (Krugman *et al.*, 2012). According to Ricardian theory, what determines the comparative advantage is the differential of labour productivity between countries. Since Ricardo, the discipline of international trade has gained increasing complexity, with main contributions from the Heckscher-Ohlin model, Krugman (1991)¹⁰ and Melitz (2003)¹¹. As said by Hellier & Chusseau (2012), the Heckscher-Ohlin-Samuelson model can be considered to describe the effects of trade openness over functional inequality.

According to Krugman *et al.* (2012), the Heckscher-Ohlin model – introduced at the beginning of the twentieth century and also known as factor-proportions theory – expands the number of factors of production defined by Ricardo. In the Ricardian model, labour was the only factor to be considered; in Heckscher-Ohlin, a second factor is added. Under certain assumptions (identical technology and preferences between countries, different factors endowment, factors with internal mobility, but not external), the Heckscher-Ohlin model has

¹⁰ In the monopolistic competition model, proposed by Krugman (1991), comparative advantage is not the only reason for the existence of trade: internal economies of scale and consumers' love of variety also play an important role in describing the patterns of international trade and in explaining the existence of intraindustry trade.

¹¹ Melitz (2003) introduces the idea of heterogeneous-firms in monopolistic competition into the trade model. Based on empirical evidence, the author suggests that only the most productive firms manage to export their production, giving rise to a mechanism of self-selection; thus, a type of microeconomic heterogeneity can influence macroeconomic outcomes.

a key proposition: a country will have a comparative advantage in products that use intensively production factors which the country has in abundance. Thus, exported goods use locally abundant factors of production.

Another important proposition under the Heckscher-Ohlin model and known as the Stolper-Samuelson theorem is that trade affects the real reward of the factor of production. The theorem argues that there will be an increase in the real reward of the factor used intensively in the export sector (which is locally abundant) and a reduction in the real reward of the factor used intensively in the import sector (locally scarce). Thus, according to Meschi & Vivarelli (2009), in the context of developing countries, which are low-skilled-labour abundant, international trade should raise the prices for this kind of work provoking a more even wage distribution. It is worth mentioning that inequality in the Heckscher-Ohlin model refers to functional inequality – *i.e.* considers the share of total national income that each of the factors of production receives (through wages, profits or rents) – rather than personal inequality.

However, according to Meschi & Vivarelli (2009), the Heckscher-Ohlin model and the Stolper-Samuelson theorem are built on overly restrictive assumptions to explain the reality. Among the limitations of the model is a too simplistic conception of the world (two countries, two products) and other conditions that cannot be verified, such as immobile factors of production and with a fixed endowment, constant returns to scale, and full employment. Another limitation presented by the Heckscher-Ohlin-Samuelson model is to focus on functional inequality rather than income inequality (although, according to Messina & Silva (2017), there is a strong connection between both: in Latin America, labour income explains 73% of the total household income on average).

According to Harisson *et al.* (2011), new theoretical explanations emerged recently based on heterogeneous firms' theories (Melitz, 2003). Important contributions have been made by economists to bring a more nuanced perspective on the connection between inequality and trade. The authors mention at least three sets of new variables incorporated into the trade models: (i) trade in tasks, model inaugurated by Feenstra & Hanson (1996) and revisited by Grossman & Rossi-Hansberg (2008), that raises the opportunity of productivity gain from offshoring, with impact in income distribution among skill-poor and skill-rich countries; (ii) search frictions and unemployment, developed by Davidson *et al.* (1999) and revisited by Mitra & Ranjan (2010), absorbing labour-market frictions into the trade model, demonstrating that this can impact the distributional effects of trade; and (iii) innovation,

introduced by Dinopoulos & Segerstrom (1999) and further explored by Thoenig & Verdier (2003), showing that R&D activities of firms can also impact income distribution. Another aspect raised by Trautwein (2019) concerns the new challenges nurtured by the digital economy, that includes other non-state agents and overlapping sovereignties, increasing trade complexity and requiring a new framework to understand its impacts over income inequality.

However, despite the existence of new theories, most empirical studies still ignore their contributions. As said by Harisson *et al.* (2011; p.277), “immense empirical literature exists on the possible linkages between trade and inequality. Most of these literatures predates the new trade models and focuses on testing the implications of the HO framework for trade-inequality linkages.”

2.4 Empirical studies on International Trade and Inequality

This section summarizes the empirical literature on trade and inequality (see Annex 1 for a schematic presentation), which we organize in three subsections. According to Hellier & Chusseau (2012), contemporary studies dedicated to exploring inequality tend to focus on the effects of trade openness. For this reason, we devote the following subsection to this topic. In addition to openness, we note that authors emphasize other aspects, such as the type of export and trading partner – thus, we dedicate a second subsection to trade structure. Finally, a third subsection is dedicated to the literature focusing on the specificities of Latin America, as this is the focus region of our study.

Openness

A significant body of literature focuses on the effects of openness over income distribution within countries. According to Anderson (2005), three different hypotheses can be drawn to distinguish the effects of openness over income inequality, in which greater openness: (i) increases inequality in all countries; (ii) decreases in developing countries, but rises in developed countries, and (iii) has a diverse effect according to the factor endowments of countries. The influence of the Heckscher-Ohlin model can be seen in the second and third hypotheses, in which the proportion of factors is determinant for income distribution.

Based on these hypotheses, Anderson (2005) suggests three conclusions. The author argues that there is virtually no support for the first hypothesis, in which openness increases inequality in every country. According to Lundberg & Squire (2003), using different measures

of openness¹² and analysing a sample for the period 1960–94 from 38 countries, there is no significant overall positive correlation between openness and income distribution. Beaton *et al.* (2017) also refute the idea that trade openness necessarily promotes income inequality.

Secondly, Anderson (2005) defends that there are contradictory evidences concerning the hypothesis of inequality reduction, after trade openness, in developing and developed countries. According to the study of Calderón & Chong (2001), analysing a sample for the period 1960-1995 from 102 countries, there is evidence of inequality reduction for developed and increase for developing countries. However, a recent study from Khan & Nawaz (2019) for CIS member countries¹³ for the period 1990-2016 shows that trade openness seems to be significant in reducing income inequality for this specific group of developing countries.

Finally, the study of Fischer (2001) supports the idea drawn on the third hypotheses. Examining a sample of 66 countries with observations for each 5 years, beginning in 1965, the author finds that the impact of openness on inequality intensifies as countries' endowments of human capital rise. Conversely, he observed the opposite effect when considering endowments of capital.

Trade structure

In addition to the effect of openness, other authors seek to explain the impact of trade over inequality and economic performance through variables describing the trade structure. The emphasis on the type of export and the type of trading partner will compose this section dedicated to the trade structure. Not all the authors described below work directly with the inequality variable. Some explore the impact of the type of products exported solely on economic performance, measured by economic growth (Isham *et al.*, 2005; Hausmann *et al.*, 2007) – however, it is worth mentioning these works as they explore important aspects of types of export; while others (Leamer *et al.*, 1999; Meschi & Vivarelli, 2009; Hartmann *et*

¹² According to Lundberg & Squire (2003; p.342), the openness indicator developed by Sachs and Warner (1995) defines that “an economy is open to trade if it satisfies four tests: (1) average tariff rates below 40 percent; (2) average quota and licensing coverage of imports of less than 40 percent; (3) a black market exchange rate premium that averaged less than 20 percent during the decade of the 1970s and 1980s; and (4) no extreme controls (taxes, quotas, state monopolies) on exports.” However, Lundberg & Squire (2003; p 330), argue that “we do not regard the Sachs-Warner index as strictly a measure of openness. In addition, we experiment with other variables that have also been called measures of openness including the share of trade in GDP.”

¹³ According to its website, the Commonwealth of Independent States (CIS) was created in December 1991 and is composed by the following units: Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan, and Ukraine. Available at <http://www.cis-stat.com/eng/cis.htm>, accessed on April 02, 2019.

al., 2017) discuss more specifically the relationship between product mix or type of trading partner and inequality.

Recent empirical studies seek to explore economic and trade structure through disaggregated data, analysing products or the mix of products, and its relationship with economic development and inequality. The cause of the composition of a given mix may vary: according to Leamer *et al.* (1999) the key idea is that product mix depends upon factor endowments – *i.e.* countries rich in natural resources present one type of product mix; while countries where natural resources are rare show a different mix. Analysing two sets of data from 1980 and 1990, the authors defend that different development paths can occur according to the intensity of the factors of production. Also, within natural resource intensive products, they differentiate the development paths of countries producing permanent and temporary crops. According to the study, permanent crops – such as bananas and coffee – present a positive association with income inequality, while temporary crops – such as cereals and forest products – are negatively associated.

Hausmann *et al.* (2007) offer a complementary explanation to what they define as a country's fundamentals (its endowments of human and physical capital, natural resources, and labour). Analysing more than 5,000 products from 1992 to 2003, the authors focus their explanation on the causes of the composition of a given mix on a range of intangible resources, called capabilities. They emphasize the mechanism of “cost discovery”, which is associated with the cost uncertainty to initiate the production of a given good. According to the authors, due to a knowledge characteristic (social return higher than private return), externalities are generated and, as a market failure, sub-optimal investment will occur without proper intervention. Hausmann *et al.* (2007) then conclude that the variety of products that an economy produces and exports is defined not only by the usual fundamentals but also by the quantity of entrepreneurs involved in cost discovery in advanced areas of the economy.

Both Leamer and Hausmann defend the importance of analysing the mix of products to comprehend the path of development adopted by a country. According to Hausmann *et al.* (2007; p.1): “not all good are alike in terms of their consequences for economic performance. Specializing in some products will bring higher growth than specializing in others.”

In the sequence of Hausmann *et al.* (2007)'s work, and in order to explain the connection between the mix of products and income inequality, Hartmann *et al.* (2017) introduces the concept of economic complexity. After analysing data from 150 countries for a period of 45 years (1963–2008) they concluded that complex products exporters have

inferior levels of income inequality if compared with simple products exporters. The authors assume that it is difficult to directly define the determinants of inequality since they depend on a diversity of factors. Thus, they seek to create an indirect measure, assuming that those determinants of inequalities are expressed in the country's mix of products. The Economic Complexity Index (ECI) combines two layers of information to define the degree of sophistication of its productive structure: diversity (measured by the number of exported products in which the country presents Revealed Comparative Advantages) and ubiquity (measured by the number of countries that export that product).

In addition to the mix of exports, another relevant variable is its degree of diversification. According to Isham *et al.* (2005), export concentration, especially in natural resources, is associated with weak institutions and slow growth. Analysing data from 1974 to 1997, the authors affirm that countries dependent on products obtained from a contracted economic or geographic source – such as minerals and oil – are inclined to higher social and economic inequality and debilitated institutions. Also, highlighting trading partners characteristics, more specifically their level of income, Meschi & Vivarelli (2009) conclude – after analysing a sample of 65 developing countries over 19 years (1980–1999) – that developing countries (specifically middle-income countries) trading with high-income countries show worst income distribution through both imports and exports.

The Latin American case

Most studies for the specific case of Latin America also focus on the relationship between openness and inequality. To the best of our knowledge, no study focuses on the connection between trade structure and income inequality for the region. Latin America is a relevant case in which trade openness may have induced structural change, followed by transformation in the trade structure and income distribution.

According to Hellier & Chusseau (2012), empirical studies looking at Latin America contradict the predictions of the HOS theory, demonstrating that trade openness has a negative effect over income inequality. The authors mention the studies of Pagés & Márquez (1998) with a sample of 18 countries in Latin America and the Caribbean for the period 1970–1996 suggesting that trade reforms had a negative impact on employment growth. Also, Green *et al.* (2001) are mentioned suggesting that – considering data from 1981 to 1999 – trade liberalization in Brazil is associated with a rise in the return of college education.

However, studies analysing more recent data show that there has been a reduction in inequality in the region at least since the 2000s. Amarante (2016) mentions the report produced by the Economic Commission for Latin America and the Caribbean (ECLAC) in 2011 to state that most Latin American countries presented falling income inequality indicators during the 2000s, after a decade (1990s) of rising inequality. Also, according to the author, a consensus has not yet been reached by recent researches seeking to explain the cause of this reduction.

Although there is no consensus, a recurrent hypothesis has been defended building on the rise of commodity prices (which have a large influence on the trade balance of these countries) during this period. According to Messina & Silva (2017), during the 2000s there was a boom in commodity prices drove by economic growth in China and other countries of the Group of Seven (G7), leading to widespread growth in Latin America. Several studies (*e.g.* Bresser-Pereira, 2008; De La Torre *et al.*, 2017; Messina & Silva, 2017; Guerra-Salas, 2018) argue that the commodity prices boom may have led some countries to experience Dutch disease¹⁴ effects, causing reduction of inequality in the short term, but with uncertain impacts in the long-run.

As Goldberg & Pavcnik (2007) suggests, as a conclusion of their theoretical and empirical review on the relationship between trade and inequality, there is no general relationship between the two and, thus, there is a need for analysing the specific situations of countries and regions:

“Overall, it appears that the particular mechanisms through which globalization affected inequality are country, time, and case specific; that the effects of trade liberalization need to be examined in conjunction with other concurrent policy reforms; and that implementation details of particular policies matter.” (Goldberg & Pavcnik, 2007; p.78).

¹⁴ The Dutch disease is a pathology that describes the adverse effects to an economy which benefits from a commodity boom in the short-run, at the expenses of de-industrialization in the long-run. According to Corden & Neary (1982), the commodity boom induces: i) an appreciation in the exchange rate; ii) a resource movement from the rest of the economy into the booming sector (resource-movement effect); iii) an increase in the domestic demand for services (spending effect), rising prices and output in the non-tradable sector, worsening de-industrialization.

Chapter 3. Methodology

This chapter describes the methodology used to estimate the effects of international trade on income inequality in Latin America. For this purpose, we began by presenting the model. Then, we describe the data and the variables employed in the model.

3.1 The model

Aiming to empirically evaluate the role of international trade on income inequality in Latin America, we use an unbalanced panel data model, combining annual data from 1997 to 2016 and cross-section data of 14 countries.¹⁵ The literature (*e.g.* Gujarati & Porter, 2009) suggests that panel data regression models are the most suitable for situations in which data combines cross-sectional and time-series observations.

The model can be described as follows:

$$I_{it} = \beta_1 + \beta_2 T_{it} + \beta_3 X_{it} + \alpha_i + \varepsilon_{it} \quad (3.1)$$

where i represents the country ($i = 1, \dots, 14$) and t represents time ($t = 1997, \dots, 2016$). I_{it} is the dependent variable and refers to a measure of inequality of a country i at time (year) t ; β_1 is the common intercept; β_2 is the vector of coefficients associated with trade variables; T_{it} is the vector of explanatory variables characterizing trade in country i at time t ; β_3 stands for the vector of coefficients associated with the control variables; X_{it} is the vector of control variables for country i at time t ; α_i is the unobserved country specific effect (in the case of the FEM this specific effect is constant whereas in the REM it is considered a random element); and ε_{it} is the error term for country i at time t .

3.2 Data

This section presents the data and sources for each of the variables used in the model. We seek to evaluate if international trade explains inequality, controlling for other determinants of inequality typically included in the literature.

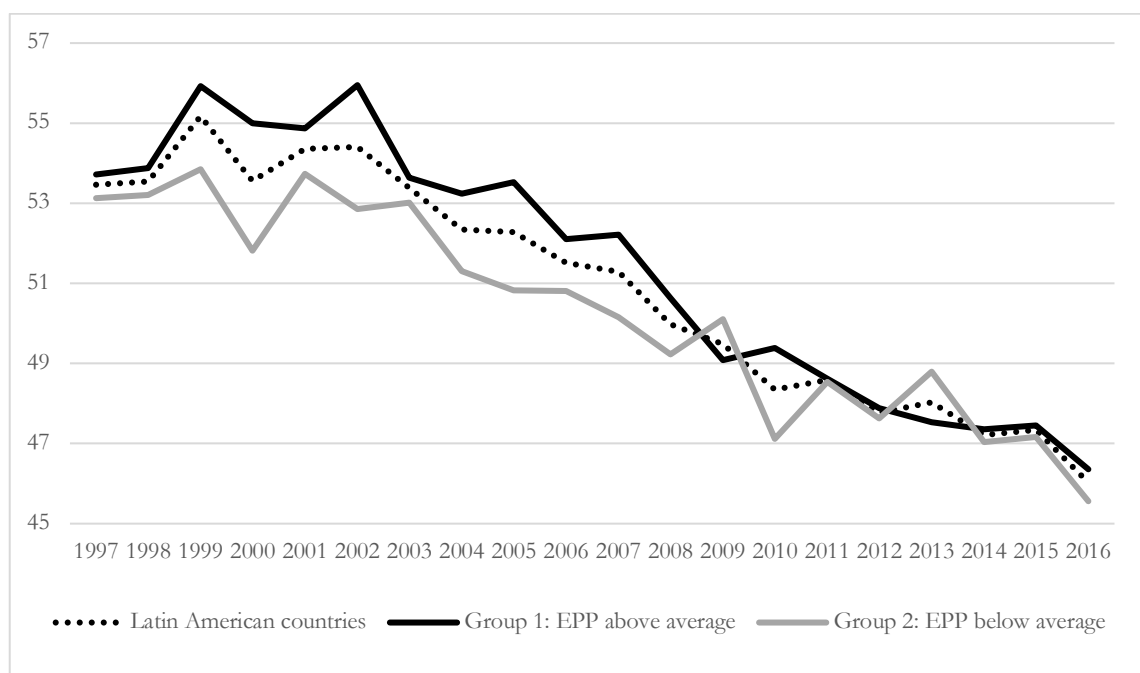
¹⁵ The dataset chosen contains 14 Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Panama, Paraguay, and Peru. Data availability for the Gini index was determinant for selecting both the time horizon and individual countries.

3.2.1 Dependent variable: Inequality

As mentioned in the previous chapter, according to Thirlwall (2011), the most common measure of income inequality is the Gini index. The index ranges from 0 (perfect equality) to 100 (perfect inequality). Data is available on an annual basis and is constructed by the World Development Indicators (WDI), World Bank.¹⁶ In order to ensure a more robust model, we also considered the Kuznets ratio to assess income inequality. The Kuznets ratio considers the proportion of income received by the top 20% and the bottom 40% of the population (Todaro & Smith, 2012). We collected data from the World Development Indicators (WDI), World Bank¹⁷ to construct the Kuznets ratio.¹⁸

As we can see in Figure 1, there is a general downward trend in income inequality in Latin America for the studied period.

Figure 1 – Gini index of income inequality in Latin America, (average), 1997-2016



Source: Own elaboration. Data for Gini was obtained at World Bank, Development Research Group; Accessed on November 24, 2018; Available at <http://databank.worldbank.org/>. Data for EPP at Socio-Economic Database for Latin America and the Caribbean (SEDILAC), *Universidad Nacional de la Plata* (CEDLAS) and World Bank, available at <http://estadisticas.cepal.org/cepalstat/>, accessed on December 08, 2018.

¹⁶ Available at <https://data.worldbank.org/indicator/>, accessed on November 24, 2018.

¹⁷ Available at <https://databank.worldbank.org/data/source/world-development-indicators#>, accessed on December 27, 2018.

¹⁸ Data is only available for quintiles. Thus, we divided the income share detained by top 20% (quintile 5) by the sum of the income share held by bottom 20% (quintile 1) and fourth 20% (quintile 2).

Note: Countries are grouped according to the ratio Exports of Primary Products to total exports (EPP). Group 1 includes countries with EPP higher than the average and group 2 considers the countries EPP lower than the average.

Also, Figure 1 shows that the degree of inequality varies according to countries' intensity in the exports of primary products. According to Leamer *et al.* (1999), inequality is positively related to tropical agriculture and basic extraction. In order to explore the links between natural resources and inequality, we gathered information on Exports of Primary Products (EPP)¹⁹ and grouped the 14 studied countries into two different groups, high and low EPP, considering as threshold the average EPP, 62.9%²⁰. As can be seen, at the beginning of the period, countries with high intensity of exports of primary products (Group 1) presented higher levels of inequality if compared with those characterized by a lower intensity of primary products exports (Group 2). However, countries' highly intensive in the exports of primary products showed an accelerated reduction in the inequality levels. In some of the studied periods, economies intensive in exports of primary products have presented similar (in 2011, 2012, 2014 and 2015) and even lower (in 2009 and 2013) levels of inequality than nations less dependent on primary products.

3.2.2 Explanatory variables

We considered explanatory variables for describing the intensity of international trade (trade openness) and its structure (economic complexity, terms of trade and natural resources rents²¹). In addition to that, we use other variables (GDP *per capita*, unemployment, employment in industry, average years of education and political stability) in order to control for the influence of independent variables on inequality. We detail and justify the choice of these variables below.

¹⁹ The Exports of Primary Products is the percentage of this type of exports in relation to total exports. Data is available at the Socio-Economic Database for Latin America and the Caribbean (SEDLAC), *Universidad Nacional de la Plata* (CEDLAS) and World Bank (at <http://estadisticas.cepal.org/cepalstat/>, accessed on December 08, 2018).

²⁰ Average calculated for the set of 14 countries.

²¹ Two other explanatory variables for trade structure (product concentration and exports of primary products) were initially tested, but the results presented a low significance level. Also, the two variables showed a strong correlation and overlap with other indicators (*e.g.* Economic Complexity Index and Natural Resources Rents).

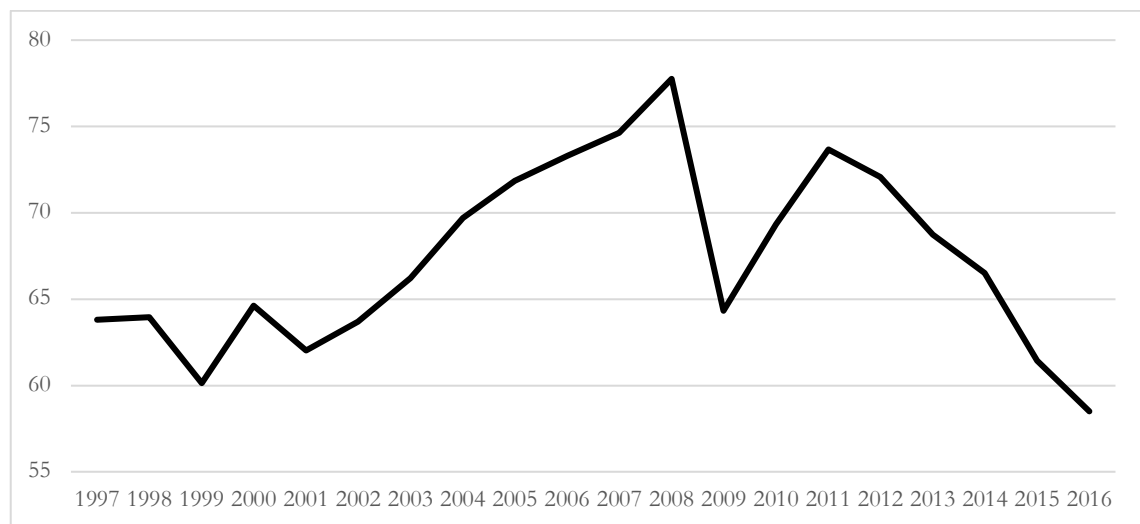
3.2.2.1 International Trade measures

Following the literature, international trade can be measured and analysed through different indicators, capturing both trade openness and its structure.

Trade openness

According to Anderson (2005), in recent decades numerous developing countries have become more open to the trade of goods and services. Krugman *et al.* (2012) point out that since the 1990s there has been rising popularity of emerging markets, which are increasingly integrated into global value chains.²² In order to assess the opening degree of Latin American economies, we use data from the World Development Indicators (WDI), World Bank.²³ The indicator is calculated by the sum of exports and imports (for total trade in goods and services) as a percentage of nominal Gross Domestic Product (GDP). According to the data (as seen in Figure 2), there is an increase in the opening process during the 1990s and 2000s, which is discontinued in 2008 (period coinciding with the global financial crisis²⁴), partly resumed in the following three years, and then taking the opposite direction.

Figure 2 – Trade openness for Latin America (average), 1997-2016



²² The foundation of Mercosur can be mentioned as an example of this integration effort. According to its official website (www.mercosur.int), Mercosur is currently a customs union and was founded in 1991. Its founding countries are Argentina, Brazil, Paraguay, and Uruguay. Mercosur was the only South American bloc during the last decades until 2012, when the Pacific Alliance was formed by Chile, Colombia, Mexico, and Peru.

²³ Available at <https://databank.worldbank.org/data/source/world-development-indicators/#>, accessed on December 27, 2018.

²⁴ In order to control for the impact of the financial crisis, we considered it as a dummy variable. We have attributed 1 for 2008 and the following years and 0 for the years before 2008.

Source: Own elaboration. Data from World Bank; Available at <https://data-bank.worldbank.org/data/> accessed on December 27, 2018.

According to Meschi & Vivarelli (2009), following the theoretical logic presented in the Heckscher-Ohlin-Samuelson model, a decrease in functional inequality should occur in developing countries when trade openness is implemented. However, empirical studies (*e.g.* Calderón & Chong, 2001; Fischer, 2001; Lundberg & Squire, 2003; Beaton *et al.*, 2017) show that the expected effect of trade openness over inequality is mixed, as both positive and negative results are observed for different groups of countries and periods.²⁵

Economic complexity

According to Hartmann *et al.* (2017), the assumption behind the Economic Complexity Index (ECI) is that the development of a country is associated with the intensity of knowledge incorporated in its economy. In turn, this knowledge is expressed by the number of activities performed and the complexity resulting from the interaction of these activities. In order to assess the complexity and the intensity of knowledge incorporated within an economy, ECI connects countries to products. According to Hartmann's metaphor, just as a model of Lego created by a child signals the availability of certain Lego pieces, a particular product exported by a country signals the availability of a certain set of capabilities incorporated into the economy.

The Economic Complexity Index was developed by a group of researchers from Harvard University and Massachusetts Institute of Technology during the 2000s. The first step in outlining the index is to define which products countries have comparative advantage. Balassa's definition of Revealed Comparative Advantage (RCA) is used with the intention of making countries and products comparable. According to Krugman *et al.* (2012), Balassa's definition states that a country has RCA in a product if it exports more than the share of global trade represented by this same product. The second step in outlining the index is to organize products and countries into a matrix, and assigning a binary value for the existence or not of RCA for the country-product correspondence. After that, rows and columns are summed and adjusted.

²⁵ Timing is crucial for understanding the differences in results. According to De La Torre *et al.* (2017), the Heckscher-Ohlin-Samuelson model fails to explain the absence in the fall of inequality during the 1990s (when most of the trade liberalization measures were implemented and inequality in countries has grown or remained stable) but is helpful to explain the downward trend in the 2000s.

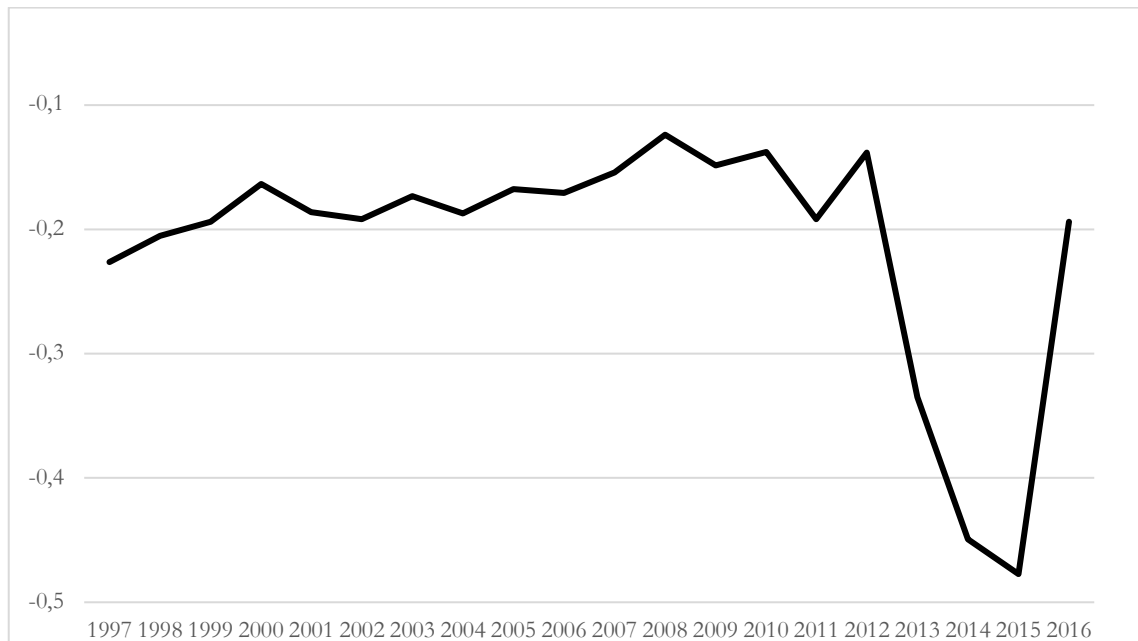
The complexity of the economy is the result of the relationship between two layers of information extracted from this data: diversity and ubiquity. Diversity is measured by the number of exported products in which the country presents Revealed Comparative Advantages; while ubiquity is measured by the number of countries that export that specific product. Some corrections and improvements are then made to the calculation in order to merge the two dimensions within a single index.

In a given country, higher ECI values reveal the production of more complex products; similarly, lower values indicate less sophisticated economies. During the period covered by our study (1997-2016), the lowest recorded value of ECI was -2.764 by Nigeria in 2009; while the highest was 2.611, registered by Japan in 2002. Data is provided by the Observatory of Economic Complexity,²⁶ which in turn uses data compiled by the United Nations Comtrade Database.

Hartmann *et al.* (2017) concluded that higher ECI is related to a decrease in inequality because the sophistication of a productive structure is decisive in a country's capacity to distribute income. However, for this specific sample of Latin American countries in the period studied, positive results for ECI as explaining inequality are expected. Contrary to what was observed by Hartmann *et al.* (2017), specialization in less sophisticated products would be associated with inequality reduction (for this set of countries highly dependent on natural resources and in a context of increasing international commodities price).

²⁶ Available at <https://atlas.media.mit.edu/en/rankings/country/eci/>, accessed on November 24, 2018.

Figure 3 – Economic Complexity Index for Latin America (average), 1997-2016

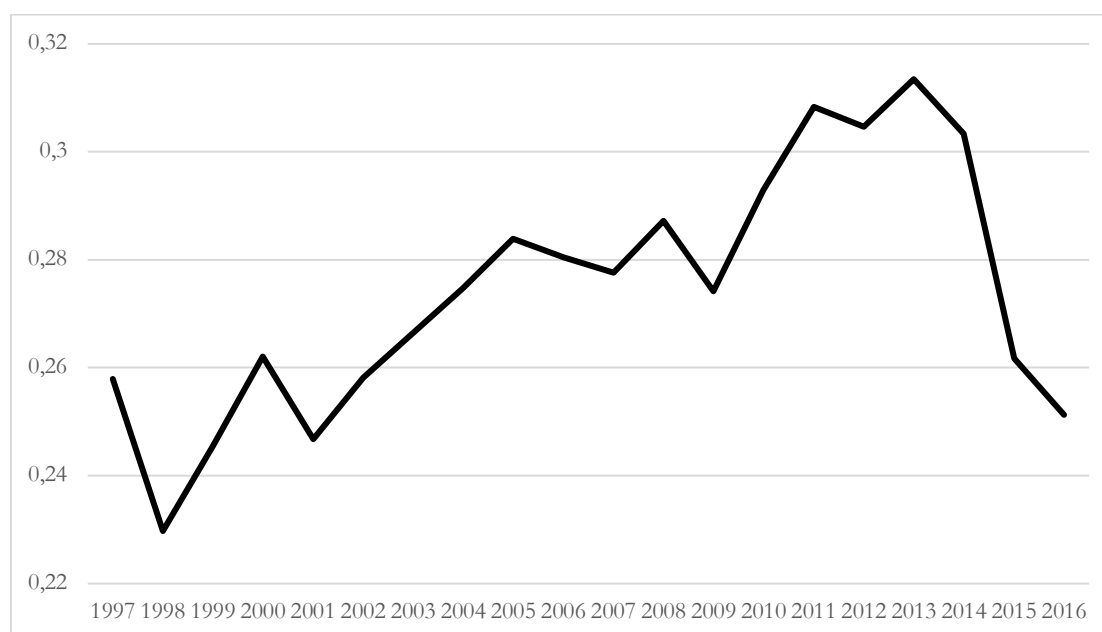


Source: Own elaboration. Data from Observatory of Economic Complexity; Available at <https://atlas.media.mit.edu> accessed on November 24, 2018.

After 2008, there is a sharp fall in the economic complexity of the Latin American countries (as seen in Figure 3). This variation can be partly attributed to the turbulence generated by the international financial crisis in the period. Also, the literature (*e.g.* Messina & Silva, 2017), suggests that the increase in the price of commodities – and consequently the generated revenue – induces countries both to reduce the diversity of exported products and to specialize in products commonly exported by other economies. This idea is reinforced by analysing the Product Hirschman Herfindahl index²⁷ for Latin America in the same period. Given the overlap between the Product Hirschman Herfindahl index the Economic Complexity index, only the latter is considered in the models. As shown in Figure 4, particularly since 2008, countries concentrated their production in a smaller set of products.

²⁷ During the 2000s, countries presented a significant increase in the Product Hirschman Herfindahl index (a measure of the degree of product concentration). A decrease in the index over time may be indicative of diversification in the exporter's trade profile. Similarly, a high concentration index may indicate the exporter vulnerability to trade shocks. The analyzed data were extracted from the United Nations Conference on Trade and Development.

Figure 4 – Product Hirschman Herfindahl index for Latin America (average), 1997-2016



Source: Own elaboration. Data from the United Nations Conference on Trade and Development; Available at <http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120>, accessed on November 24, 2018

Natural resources rents

According to Leamer *et al.* (1999), there is a vast literature exploring the link between natural resources endowments and economic performance. Natural resources rents seemed to be the most appropriate indicator to show national growth as a function of international commodity prices. Data on natural resources rents are extracted from the World Bank,²⁸ being total natural resources rents the sum of rents for oil, natural gas, coal, mineral, and forest. Natural resources rents are estimated as the difference between a commodity's price and its cost of production, multiplied by the quantities produced and considered as a share of Gross Domestic Product (GDP).

According to Messina & Silva (2017), during the 2000s there was a boom in commodity prices drove by economic growth in China and other countries of the Group of Seven (G7). In the same period (as seen in Figure 5), revenues coming from natural resources have risen sharply in the Latin American countries. The increase in natural resources rents in the

²⁸Available at <https://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS>, accessed on December 08, 2018

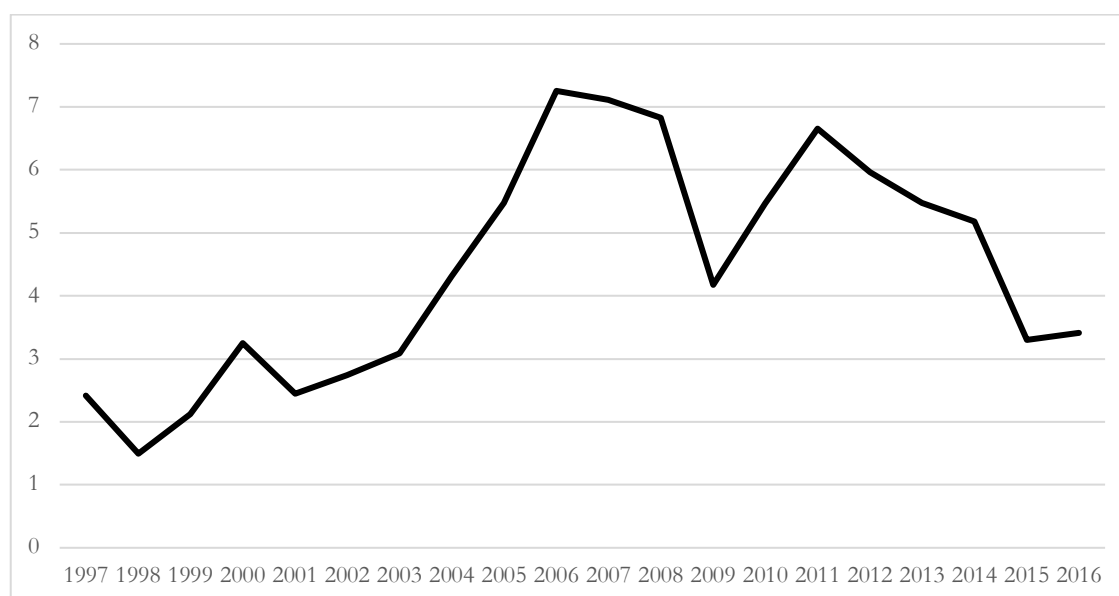
studied period might explain a reduction in income inequality for the region. The mechanism that supports this hypothesis is sustained by the Dutch disease.

According to Bresser-Pereira (2008), the Dutch disease is a market failure initiated in the presence of abundant and inexpensive human or natural resources that pushes the local currency up, making the production of more technological tradable goods non-profitable. The Dutch disease impacts on inequality through the spending effect mechanism. According to Nafziger (2006), through this channel, the income growth (a consequence of the performance of the booming sector)²⁹ induces an expansion of internal demand, especially for non-tradable goods, driving prices for these goods higher and transferring labour away from the manufacturing to the non-tradable goods sector. Guerra-Salas (2018) states that as the latter is a low-skill intensive sector, the spending effect increases the relative demand for low-skilled workers, reducing the skill premium³⁰ and, thus, contributing to a reduction in income inequality. Therefore, the correlation for natural resources rents and inequality for this specific case (Latin America in the 1997-2016 period) is expected to be negative.

²⁹ According to Nafziger (2006), following the Corden & Neary (1982) model, the Dutch disease presents one non-tradable goods sector and two tradable goods sectors (one is booming and the other is lagging). Within the tradable goods sector, the booming one usually occurs from the exploitation of natural resources or cheap labour; while the lagging is commonly the manufacturing sector. On the other hand, the non-tradable goods sector corresponds to services.

³⁰ According to Guerra-Salas (2018; p.620), skill premium is “the gap between high-skilled and low-skilled wages.”

Figure 5 – Natural resources rents in Latin American (average) (% of GDP), 1997-2016



Source: Own elaboration. Data from World Bank; Available at <https://data.worldbank.org/indicator/> accessed on December 08, 2018

Terms of trade

According to Krugman *et al.* (2012), terms of trade describes the ratio between the unitary value of export and import. This is a useful indicator for international and temporal comparisons. The concept of terms of trade is central in the literature exploring the connection between factor endowments and inequality. According to Leamer *et al.* (1999), Raul Prebisch suggests an impoverishing effect of natural resources; and one of the foundations of such impoverishing being the declining terms of trade. The central idea is that as countries enrich, they demand relatively less primary goods in comparison with manufactures and services, contributing to a decline in terms of trade for primary product exporters.

We use the net barter terms of trade index provided by the World Bank, with data from both UNCTAD and the International Monetary Fund (IMF).³¹ The index is calculated relative to the base year 2000 and is measured as the percentage ratio of the export unit value indexes to the import unit value indexes. According to Calderón & Chong (2001), the effects of terms of trade over inequality is inconclusive, as the link obtained in the tests conducted are not significant. However, based on the work of Messina & Silva (2017) – conducted

³¹ Available at <https://data.worldbank.org/indicator/TT.PRI.MRCH.XD.WD?view=chart>, accessed on November 24, 2018.

specifically for the Latin American region and for a similar period – we expect to find negative results for this variable, as the gains in terms of trade (driven by the commodity boom) are expected to contribute to a reduction in income inequality.

3.2.2.2 Control variables

Independent variables are used in order to control for the influence of other variables on inequality, defined on the basis of the literature explored in Chapter 2.

Per capita Gross Domestic Product (GDPpc)

The indicator is obtained by dividing the Gross Domestic Product (GDP) by midyear population. The GDP is calculated at purchasers' prices (*i.e.* converted to international dollars using Purchasing Power Parity rates) and data is provided by the World Bank.³² According to Kuznets (1955), a quadratic relation is expected between GDPpc and inequality as countries in both earlier and advanced stages of economic development are expected to have lower levels of inequality, while countries in intermediary stages are expected to present higher levels. However, when considering a relatively homogeneous group of countries and a short period of time, the quadratic relation is difficult to be perceived. For this reason, we will consider a linear and negative relation between GDPpc and income inequality.

Employment in industry

According to Nafziger (2006), the Lewis model suggests that economic growth occurs as a consequence of an increase of the modern sectors and a decrease in the size of the subsistence sectors. In order to observe the growth of the modern sector, we looked at the share of employment in industry. Following the Kuznets (1955) hypothesis, economic growth should induce a decrease in inequality in the later stages of economic development through the process of structural change. Thus, the expected effect of employment in industry over inequality is to be negative (*i.e.* the higher the percentage of employment in industry, lower the inequality). Data shows the share of employment in industry over total employment

³² Available at <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?view=chart>, accessed on November 24, 2018

and was extracted from the World Development Indicators, whose source is the International Labour Organization (ILO).³³

Unemployment

According to Sen (1973), unemployment is closely connected with inequality. Since wage is considered one of the main sources of income, its absence should contribute to an increase in inequality. Based on empirical work on inequality for the Latin America region (*e.g.* De La Torre *et al.*, 2017; Messina & Silva, 2017), the expected result is positive (*i.e.* higher unemployment should expand inequality). Data was extracted from the World Development Indicators, whose source is the International Labour Organization (ILO).³⁴

Real minimum wage

According to the Heckscher-Ohlin model, trade affects the real reward of the factors of production,³⁵ thus in order to capture the real reward of labour we use real minimum wage as a control variable. According to Meschi & Vivarelli (2009), in developing countries, which are low-skilled-labour abundant, international trade should raise the prices for this kind of work provoking a more even wage distribution.³⁶ For this reason and also as a consequence of the macroeconomic context,³⁷ we expect to find a negative effect on income inequality (*i.e.* the higher the minimum wage, lower the inequality). Data for the real minimum wage

³³ Available at <https://data.worldbank.org/indicator/>, accessed on January 29, 2019. According to ILO, “employment is defined as persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement.” Also, according to ILO, “the industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water).”

³⁴ Available at <https://data.worldbank.org/indicator/>, accessed on January 29, 2019. According to ILO, “unemployment refers to the share of the labour force that is without work but available for and seeking employment.”

³⁵ The Stolper-Samuelson theorem argues that there will be an increase in the real reward of the factor used intensively in the export sector (which is locally abundant).

³⁶ The Heckscher-Ohlin model refers to functional inequality (*i.e.* considers the share of total national income that each of the factors of production receives, through wages, profits or rents) rather than personal inequality (*i.e.* income received by individual or households, regardless of the factor through which the income is acquired).

³⁷ The minimum wage can affect the distribution of income in different ways. According to Duryea *et al.* (2017), the macroeconomic context is an important variable to understand the direction of this effect. In a rapidly growing economy, an increase in the minimum wage should contribute to the enrichment of the low-income sector. However, in a scenario of economic slowdown, unemployment and informality can increase. The countries of Latin America in the period studied presented strong economic growth and had a significant increase in their minimum wages. According to Messina & Silva (2017; p.156), “in Latin America, minimum wages doubled or tripled over roughly a decade in many countries. In Brazil, the real minimum wage increased by 130% from 1995 to 2014, in Chile it doubled over the same period, in Peru it doubled from 1996 to 2013, and in Uruguay it doubled during the 2000s.”

annual index (with 2000=100) was taken from CEPAL (*Comissão Econômica para a América Latina e Caribe*).³⁸

Education

As well as the GDPpc, educational variables are frequently used in the literature that deals with inequality (*e.g.* Clarke, 1995; Nafziger, 2006). As a control variable, we use the average years of formal education for adults aged between 25 and 65. Data is available at the Socio-Economic Database for Latin America and the Caribbean (SEDLAC), *Universidad Nacional de la Plata* (CEDLAS) and World Bank.³⁹ According to Calderón & Chong (2001), the expected effect of schooling over inequality is negative.

Institutional quality

According to Hartmann *et al.* (2017), the complexity of a country's economic structure is associated with the degree of sophistication of its institutions. Data is extracted from the Worldwide Governance Indicators, provided by the World Bank⁴⁰ and covers six major dimensions associated with the quality of institutions within a given country: Control of Corruption, Government Effectiveness, Political Stability and Absence of Violence, Regulatory Quality, Rule of Law, and Voice and Accountability. According to Hartmann *et al.* (2017), the expected general effect of the quality of institutions over inequality is negative, with some variations for each dimension. The author also finds that Political Stability is the more significative dimension (*i.e.* countries presenting higher political stability tend to show lower levels of inequality).

Financial crisis dummy

In order to control for the impact of the financial crisis, we considered it as a dummy variable. We have attributed 1 for 2008 and the following years and 0 for the years before 2008.

³⁸ Available at http://estadisticas.cepal.org/cepalstat/web_cepalstat/estadisticasIndicadores.asp/, accessed on February 27, 2019.

³⁹ Available at http://estadisticas.cepal.org/cepalstat/web_cepalstat/estadisticasIndicadores.asp?idioma=e, accessed on December 08, 2018.

⁴⁰ Available at <https://datacatalog.worldbank.org/dataset/worldwide-governance-indicators>, accessed on December 08, 2018.

3.3 Descriptive statistics

In this section, we present some statistical features on the variables included in this study.⁴¹ The descriptive statistics of the variables are shown in Table 1 (variables are organised into three groups: dependent, explanatory variables of international trade, and control variables). The main source is the World Bank and data for variables contain between 238 and 280 observations, on an unbalanced panel of 14 countries covering the period from 1997 to 2016. Statistical description for each variable is provided, including mean, median, maximum and minimum values and standard deviation.

Table 1 – Descriptive statistics

Classification	Variable	Description	Obs.	Mean	Median	Maximum	Minimum	Standard deviation	Source
Dependent variable	GINI	Gini index of income inequality	239	50.77	50.80	61.60	40.00	4.57	World Bank
	KUZR	Kuznets ratio of income inequality	239	2.34	2.31	3.23	1.614	0.35	World Bank
Explanatory variables – International trade	OPEN	Trade (% GDP)	280	67.31	62.55	166.70	16.44	32.01	World Bank
	ECI	Economic complexity index	280	-0.18	-0.11	1.10	-1.334.99	0.53	Observatory of Economic Complexity
	TOT	Net barter terms of trade index (1997=100)	280	117.55	103.71	283.19	10.52	47.59	World Bank
	NRR	Natural resources rents (% of GDP)	280	4.41	2.51	21.42	0.06	4.64	World Bank
Control variables	GDPpc (Log)	Log of GDP per capita, PPP (constant international \$)	280	9.07	9.10	10.06	7.83	0.50	World Bank
	EMPI	Employment in industry (% of total employment)	280	20.67	20.61	27.30	14.07	2.91	World Bank
	UNEMPL	Unemployment, total (% of total labour force)	280	6.93	6.37	20.52	2.01	3.39	World Bank
	MIN WAGE	Real minimum wage (average annual index, with 2000=100)	275	120.76	106.30	364.40	77.80	39.58	CEPAL
	AYE	Mean of Years of education (adults aged 25 to 65)	238	8.37	8.41	11.43	5.01	1.43	SEDLAC (CEDLAS and The World Bank)
	GPS	Worldwide Governance Indicators (WGI): Political Stability	238	-0.29	-0.24	1.09	-2.37	0.62	World Bank

The Pearson correlation coefficients between each pair of variables is shown in Table 2. Contradicting what was expected, trade openness presents a positive correlation with Gini index, while Economic Complexity Index shows a non-significative correlation. As expected, terms of trade, natural resources rents, GDP *per capita*, employment in industry, real

⁴¹ Source of all Tables: own elaboration, using the software Eviews10.

minimum wage, average years of education and political stability are negatively correlated with inequality measures. By the same token, unemployment is positively correlated with inequality measures. In addition, we note that the correlation between explanatory and control variables is not high, except for GDPpc and average years of education.

Table 2 – Correlation matrix

	GINI	KUZR	OPEN	ECI	TOT	NRR	GDPpc (Log)	AYE	GPS	EMPI	UNEMPL	MIN WAGE
GINI	1.0000											
KUZR	0.9825 *** (0.0000)	1.0000										
OPEN	0.1402 ** (0.0302)	0.0925 (0.1538)	1.0000									
ECI	0.0249 (0.7012)	0.0671 (0.3015)	-0.1228 (0.0401)	1.0000								
TOT	-0.0497 (0.4441)	-0.0751 (0.2471)	0.1453 ** (0.0150)	-0.0126 (0.8337)	1.0000							
NRR	-0.0924 (0.1546)	-0.0749 (0.2489)	-0.2137 *** (0.0003)	-0.2753 *** (0.0000)	0.4001 *** (0.0000)	1.0000						
GDPpc (Log)	-0.4845 *** (0.0000)	-0.4474 *** (0.0000)	-0.2684 *** (0.0000)	0.4743 *** (0.0000)	0.4465 *** (0.0000)	0.1941 *** (0.0011)	1.0000					
AYE	-0.4603 *** (0.0000)	-0.4741 *** (0.0000)	-0.1579 ** (0.0147)	0.0339 (0.6028)	0.5635 *** (0.0000)	0.2912 *** (0.0000)	0.7691 *** (0.0000)	1.0000				
GPS	-0.2730 *** (0.0001)	-0.2760 *** (0.0001)	0.1990 *** (0.0020)	0.0930 (0.1526)	-0.0362 (0.5788)	-0.1453 ** (0.0250)	0.3053 *** (0.0000)	0.1691 ** (0.0146)	1.0000			
EMPI	-0.2236 *** (0.0005)	-0.2063 *** (0.0013)	-0.1047 * (0.0803)	0.4248 *** (0.0001)	-0.1198 ** (0.0453)	-0.0015 (0.9801)	0.2275 *** (0.0001)	-0.0375 (0.5647)	-0.3095 *** (0.0000)	1.0000		
UNEMPL	0.3553 *** (0.0000)	0.3554 *** (0.0000)	-0.2528 *** (0.0000)	0.2333 *** (0.0001)	-0.0898 (0.1341)	-0.0832 (0.1651)	0.1645 *** (0.0058)	0.1916 *** (0.0030)	-0.1241 * (0.0559)	-0.0640 (0.2858)	1.0000	
MIN WAGE	-0.2425 *** (0.0002)	-0.2736 *** (0.0000)	-0.1080 * (0.0737)	-0.1669 *** (0.0055)	0.1528 ** (0.0112)	0.1978 *** (0.0010)	0.2055 *** (0.0006)	0.2154 *** (0.0009)	0.0397 (0.5470)	0.0808 (0.1818)	-0.1241 ** (0.0397)	1.0000

Notes: (1) p-value in parenthesis; (2) significance level at 1% (***), 5% (**) and 10% (*).

3.4 Model specification

We selected nine models that combine different explanatory (international trade) and control variables, using as dependent variable the Gini index of income inequality. In addition, to ensure the robustness of the results, we estimated the same models using the Kuznets ratio as dependent variable (presented in Annexes 2 and 3). In this section, the specification and diagnostic tests of the selected models are displayed (in Table 3). The tests for correlated random effects (Hausman tests for cross-section and for period) and for redundant fixed effects (likelihood ratio) are shown with the intention of establishing the correct panel data model.

According to the literature (*e.g.* Gujarati & Porter, 2009), in order to define the specification of the common effects in the models the Hausman test should be used. If the null hypothesis is rejected, we can conclude that there is no correlation between the regressors and the common effects, demonstrating the adequacy of the fixed effects model (which is the case for models 1, 2, 3 and 7). If the null hypothesis is not rejected, it shows the adequacy of the random effects models (which is the case for models 4, 5, 6, 8 and 9). Also, the likelihood ratio test (redundant test) was conducted. As shown in Table 3, the redundant test indicates that combined cross-section and period effects (for the fixed effects models) is not redundant.

Table 3 – Specification and diagnostic tests

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Hausman test – cross-section	0.0000	0.0000	0.0000	0.2382	0.8268	0.8438	0.0043	0.7785	0.4659
Hausman test – period	0.0000	0.0000	0.0000	0.0000	0.0000	0.0088	0.0000	0.0294	0.0002
Redundant fixed effect – cross-section	0.0000	0.0000	0.0000	---	---	---	0.0000	---	---
Redundant fixed effect – period	0.0003	0.0002	0.0000	---	---	---	0.0024	---	---
Redundant fixed effect – cross-section/period	0.0000	0.0000	0.0000	---	---	---	0.0000	---	---
Random or Fixed effects	Fixed	Fixed	Fixed	Random	Random	Random	Fixed	Random	Random
Cross section and period effects	Yes	Yes	Yes	No	No	No	Yes	No	No

Notes: p-values reported in table.

Chapter 4. Trade and Inequality in Latin America, 1997-2016

This chapter analyses the effects of international trade over income inequality in Latin America. For this purpose, we proceed with an econometric regression estimation, through a panel data for the period between 1997 and 2016. Data availability for the Gini index (retrieved from the World Development Indicators) was determinant for selecting both the time horizon and individual countries. Thus, the dataset chosen contains 14 Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Panama, Paraguay, and Peru.

The estimated results are shown in Table 4 and consider the Gini index as the dependent variable. Overall, according to the adjusted R-Squared, the models explain between 62% and 82% of the variation in the inequality measure. To ensure the robustness of the results, we also tested the models using the Kuznets ratio as the dependent variable. We found very similar results for both measures of inequality. The models using the Kuznets ratio are shown in Annex 2.

International trade

The regression results demonstrate that trade openness affects income inequality. As revealed in the models, an increase in trade openness (as a percentage of GDP) of 1 percentage point results in a decrease between 0.02 and 0.05 points in Gini index. In all models, the variable is significant and shows a negative impact over income inequality, presenting evidence that trade openness contributes to reducing income inequality between 1997 and 2016 in Latin America.⁴²

⁴² Note that the fact that the correlation matrix has presented an opposite result for the relation between Gini index and trade openness is due to the effect of missing variables, considered now in the regression models.

Table 4 – Determinants of the income inequality in Latin America, 1997-2016: Gini index

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	55.75823 (0.0016) ***	55.10430 (0.0017) ***	36.95487 (0.0832) *	137.9728 (0.0000) ***	107.5324 (0.0000) ***	91.32259 (0.0000) ***	34.57319 (0.0653) *	116.0549 (0.0000) ***	107.8939 (0.0000) ***
Trade openness (% GDP)	-0.045081 (0.0106) **	-0.043264 (0.0106) **	-0.038470 (0.0252) **	-0.041012 (0.0050) ***	-0.025537 (0.0509) *	-0.022859 (0.0800) *	-0.046020 (0.0102) **	---	-0.031138 (0.0369) **
Economic complexity index	---	3.112355 (0.0002) ***	3.100355 (0.0002) ***	2.931286 (0.0001) ***	2.261848 (0.0007) ***	2.487680 (0.0004) ***	---	2.475656 (0.0014) ***	0.795364 (0.0496) **
Net barter terms of trade	---	---	-0.009299 (0.0234) **	---	---	---	---	---	0.015494 (0.2041)
Natural resources rents (% of GDP)	---	---	---	0.059076 (0.2955)	---	---	---	-0.018346 (0.0740) *	0.005120 (0.9379)
Log GDP per capita	-0.208287 (0.9130)	-0.078117 (0.9674)	2.009033 (0.3939)	-9.268734 (0.0000) ***	-5.298155 (0.0000) ***	-4.360464 (0.0000) ***	2.013205 (0.3214)	-7.404943 (0.0000) ***	-5.014674 (0.0012) ***
Unemployment	---	---	---	---	---	0.302768 (0.0000) ***	---	0.361093 (0.0000) ***	0.313281 (0.0042) ***
Employment in industry (% of total employment)	---	---	---	---	-0.257191 (0.0073) ***	---	---	---	0.050953 (0.6100)
Real minimum wage (average annual index)	---	---	---	---	---	---	---	---	-0.018386 (0.0001) ***
Average years of education	---	---	---	---	---	---	---	---	-1.427912 (0.0170) **
WGI: Political Stability	---	---	---	---	---	---	-1.729134 (0.0183) **	---	-0.018147 (0.9751)
Financial crisis (dummy = 1)	---	---	---	---	-2.599426 (0.0000) ***	-2.255036 (0.0000) ***	---	---	---
Model summary									
R-squared	0.833173	0.843362	0.845626	0.626157	0.674259	0.690354	0.849281	0.649533	0.684331
Adjusted R-squared	0.805369	0.816355	0.818114	0.619767	0.667269	0.683709	0.821721	0.643542	0.667804
F-statistic	29.96545	31.22800	30.73645	97.98283	96.45835	103.8943	30.81557	108.4200	41.40643
Prob (F-statistic)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Durbin-Watson stat	0.883491	0.970613	0.963323	0.812827	0.939820	0.896611	0.749595	0.745317	0.729027
Observations	239	239	239	239	239	239	208	239	202
Number of countries	14	14	14	14	14	14	14	14	14

Notes: (1) Significance level at 1% (***) , 5% (**) and 10% (*); p-value in parenthesis.

(2) Models 1, 2, 3 and 7 are estimated controlling for cross-section and period fixed effects. Models 4, 5, 6, 8 and 9 are estimated using random effects. All models use the White (diagonal) as coefficient covariance method for heteroskedasticity correction.

The results are in accordance with the more recent empirical findings of Beaton *et al.* (2017), showing that trade openness can stimulate economic growth without negatively affect income inequality. In contrast, the results indicate divergence with some previous studies (*e.g.* Calderón & Chong, 2001; Fischer, 2001), whose sample was restricted to data prior to the 2000s, and consider information from economies with a high degree of heterogeneity, both in relation to trade structure and geographic location. Fischer (2001) associates a decrease in inequality to labour abundant countries; while Calderón & Chong (2001) links a diminishing inequality to export manufacturing economies.

According to Camarero *et al.* (2016), after several crises in the 1980s, the Latin American countries went through structural adjustment programmes that replaced the import substitution policy, diffused in most economies, by trade liberalization measures. De La Torre *et al.* (2017) state that the first period that followed the trade liberalization process showed an increase in income inequality – a trajectory that was reversed at the beginning of the 2000s, more precisely in 2003. The authors point out that this trend contrasts not only with data for this region during other periods but also with other regions in the same period.

The results demonstrate that economic complexity also affects income inequality (Models 2, 3, 4, 5, 6, 8, 9). The Economic Complexity Index is always highly significant: in all models – both using the Gini index and the Kuznets ratio as the dependent variable – it presents a level of significance of at least 5%. In every model, the variable shows a positive impact over income inequality. This result contradicts what was expected according to Hartmann *et al.* (2017), that suggested that a reduction of economic complexity should produce an increase in inequality.

However, it is worth noting that data used by Hartmann *et al.* contemplates the period between 1963 and 2008 and therefore fail to consider a relevant period of the sample of this study (period in which there is the strongest reduction of ECI and which is characterized by intense turbulence due to the global financial crisis). Also, the sample used by the authors considers 150 countries, from different regions across the globe, while this study uses a quite narrow sample of Latin American countries. Finally, Hartmann *et al.* find at least two exceptions for the negative relation between economic complexity and inequality, one of which is

Mexico – the second largest economy⁴³ in Latin America.⁴⁴ In addition, De La Torre *et al.* (2017), point out that the trend presented by Latin America in this period is exceptional, both compared to its history, and to the situation of other countries in the period.

Our results then show that the “simplification” (as opposed to complexification) of the economy led to a reduction in income inequality. This “simplification” means concentrating the production on products whose knowledge intensity is low. The concentration piece can be perceived by analysing the Product Hirschman Herfindahl index⁴⁵ for Latin America in this period. As shown in Figure 4 of the previous chapter, in the period under analysis, Latin American countries concentrated their production in a smaller set of products. The low knowledge intensity in the exports products can be deducted from the growth in natural resources rents (shown in Figure 5 of the previous chapter), following the logic of the Dutch disease.⁴⁶ Thus, the concentration (rather than diversification) in the production of low knowledge intensity products (rather than high knowledge intensity products) contributed to the fall both in the Economic Complexity Index and in income inequality. According to the literature (*e.g.* Bresser-Pereira, 2008; De La Torre *et al.*, 2017; Messina & Silva, 2017; Guerra-Salas, 2018), one of the consequences of the Dutch disease is the reduction of inequality through changes in the labour market. Such a strategy poses risks in the long run but has proved effective in reducing inequality in the short term, in the face of a favourable external environment (*e.g.* increase in commodity prices) and other domestic conditions.

Moreover, the regression results demonstrate that terms of trade may also affect income inequality. In model 3 (both for the Gini index in Table 4 and for the Kuznets ratio in Annex 2) the variable is significant (for at least 5%) and presents a negative result. We can conclude that the increase in the terms of trade in the period contributed to a reduction of inequality in the region. This result is in accordance with the work of Messina & Silva (2017), which demonstrates that the gains in terms of trade were driven by the commodity boom.⁴⁷

⁴³ According to the GDP Ranking, provided by the World Bank. Available at <https://datacatalog.worldbank.org/dataset/gdp-ranking>, accessed on December 08, 2018.

⁴⁴ The other relevant exception mentioned by Hartmann *et al.* (2017) is Australia. The country presents both low complexity and low inequality levels.

⁴⁵ Given the overlap between the Product Hirschman Herfindahl index the Economic Complexity index, only the latter is considered in the models.

⁴⁶ According to Bresser-Pereira (2008), the Dutch disease may occur in the presence of abundant and inexpensive human or natural resources, in a situation in which it leads to currency appreciation, reduction of the competitiveness of the manufacturing sector and, finally, to low profitability of technological tradable goods.

⁴⁷ According to De La Torre *et al.* (2017), not all countries have benefited equally, though. The authors divide the Latin American economies in two different groups, in which “commodity-boom countries are those which registered annualized growth in terms of trade above 2% in the 2003–2013 period (Chile, Bolivia, Colombia,

According to the authors, labour benefited from the boom, promoting a structural change in the economy and a decrease in income inequality.

Similarly to the terms of trade, natural resources rents also shows a negative result in the estimation (when significant) (Model 8), demonstrating that the increase in income from natural resources contributed to the fall in inequality measures. From the work of Messina & Silva (2017), we can deduct that the gains both in the terms of trade and in the income of natural resources rents are part of the same process initiated by the boom in commodity prices and that impacted the labour market in the region. According to the literature (*e.g.* Bresser-Pereira, 2008; De La Torre *et al.*, 2017; Messina & Silva, 2017; Guerra-Salas, 2018), some of these countries witnessed Dutch disease effects that may have led to the fall in inequality, through the spending effect mechanism (*i.e.* positive performance of the booming sector leading to exchange rate appreciation, income growth, expansion of internal demand (particularly for non-tradable goods), higher prices for the service sector, transference of labour from the manufacturing to non-tradable (low-skill intensive) sector, increase of the relative demand for low-skilled workers, and finally reduction of skill premium).⁴⁸

Control variables

When controlled by GDP *per capita*, all models in which the variable is significant (tested both with Gini index and Kuznets ratio as dependent variables) confirm a negative relationship between economic growth and inequality (*i.e.* higher growth, lower inequality). The results are in accordance with Milanovic (2002) that suggests that growth solely is one of the main factors for inequality reduction.

Focusing on structural change variables, the results show that employment in industry (as a percentage of total employment) presents a negative result when significant (Model 5). This result is in accordance with Fields (1987), according to whom the economic growth

Peru, Ecuador, Brazil, and Argentina)” and “Non-boom countries are the Dominican Republic, Guatemala, Honduras, Mexico, Paraguay, El Salvador, and Uruguay.” De La Torre *et al.* (2017; p. 320).

⁴⁸ Using a single country (Brazil) as a sample, Adão (2015) notes a parallel process in which there is a transference of labour from the manufacturing to the natural resource (booming) sector (also low-skill intensive), with similar results. If the spending effect causes an indirect de-industrialization, the effect described by Adão (2015) provokes a direct de-industrialization.

through the enrichment of the poorest⁴⁹ is consistent with the observed trend of reducing inequalities.⁵⁰

When controlling for other variables, the fact that unemployment has such significant results (significance level at 1% or 5% for all the models) (Models 6, 8, 9) reinforces the hypothesis that the inequality reduction mechanism is linked to the labour market. As expected, the regression shows a positive result for unemployment (as a percentage of total employment), demonstrating that less unemployment results in lower inequality. The results are in accordance with De La Torre *et al.* (2017), that demonstrated that commodity boom nurtured labour participation, reducing unemployment, favouring the low-income sector and therefore decreasing inequality.

Still within the scope of labour market, results show that the real minimum wage is highly significant (tested both with Gini index and Kuznets ratio) and it has a negative impact on inequality. As suggested by Duryea *et al.* (2017) and Messina & Silva (2017), in a rapidly growing economy, an increase in the minimum wage should contribute to the enrichment of the low-income sector, and thus reducing inequality.

In addition to that, average years of education is significative and negative in all models in which is tested, supporting the studies (*e.g.* Clarke, 1995; Nafziger, 2006; Calderón & Chong, 2001) that explore the relationship between income inequality and education, and demonstrated the impact of the latter on reducing the first.

Also, with respect to institutional variables, political stability shows negative results for all models. As observed in Hartmann *et al.* (2017), this variable demonstrates that the degree of sophistication of a country's institutions contribute to the reduction of inequality.⁵¹

⁴⁹ As detailed in the previous chapter, through (i) enrichment of the high-income sector, (ii) enrichment of the low-income sector or (iii) enlargement of the high-income sector.

⁵⁰ Despite changes in the labour market being the main mechanism responsible for reducing inequalities in the period (according to Messina & Silva (2017), in Latin America labour income explains 73% of the total household income), there are exceptions such as Mexico, “where the contribution of nonlabour income (such as pensions and other social transfers) was larger than that of labour income” and Brazil “where the contribution of labour and nonlabour income were similar, with pension income alone contributing to 18% of the total reduction in income inequality” (Messina & Silva, 2017; p.17). Also, despite the government's role in reducing inequalities (through social transfers) have several causes that go beyond the scope of this work, it is worth noting that part of the government's capacity to perform such transfers may be associated with the Dutch disease, as a consequence of the growth in revenues (taxes) caused by the growth in the booming (natural resources) sector.

⁵¹ In accordance with Hartmann *et al.* (2017), we found that among the different dimensions associated with the quality of institutions, extracted from the Worldwide Governance Indicators, the most relevant one was Political Stability and therefore this is the only one we reported, after testing for all the six dimensions.

Finally, the international financial crisis – considered as a dummy variable – is significant and presents negative results, demonstrating its impact in reducing income inequality in the Latin American region.

Chapter 5. Conclusions

Historically high, income inequality in Latin America declined in the 2000s. Among the explanations, greater economic openness (due to changes in the trade policies carried out mostly in the 1990s) and a particular economic and trade structure (specialized in the production and export of natural products) are key issues (Leamer *et al.*, 1999; Calderón & Chong, 2001; Fischer, 2001; Anderson, 2005; Meschi & Vivarelli, 2009; Beaton *et al.*, 2017; Hartmann *et al.*, 2017). Considering an external and more global perspective, the boom in commodities prices is a crucial explanation (Bresser-Pereira, 2008; De La Torre *et al.*, 2017; Messina & Silva, 2017; Guerra-Salas, 2018).

The mechanisms through which the local (trade structure and opening policies) and global (commodity price boom) contexts explain the reduction in inequality are delineated by theories of international trade (especially Heckscher-Ohlin-Samuelson model) and structural change (Kuznets, 1955; Lewis, 1955; Adelman & Morris, 1973; Fields, 1987). With these theories as a background, we can describe how the Dutch disease (more specifically through the spending effect) resulted in the expansion of internal demand,⁵² transference of labour from the manufacturing to the non-tradable goods sector,⁵³ enrichment of low-income population and reduction of income inequality. Thus, this process of economic “simplification” (as opposed to complexification) – through which occurs the concentration (rather than diversification) in the production of low knowledge intensity products (rather than high knowledge intensity products) – resulting from greater openness to international trade can explain the reduction of income inequality in Latin America for the studied period.

In this dissertation, we considered an unbalanced panel data model, combining annual data for 14 Latin American countries from 1997 to 2016, to assess the effects of international trade (using trade openness, economic complexity, terms of trade, and natural resources rents as proxies) on income inequality (Gini index and Kuznets ratio). We found that international trade variables are statistically significant in explaining a reduction on income inequality, controlling for GDP *per capita*, unemployment, employment in industry, real

⁵² As a consequence of the performance of the booming sector, countries witness income growth and currency appreciation inducing to an expansion of internal demand, which is especially concentrated on non-tradable goods. This expansion leads to higher prices for non-tradable goods and wage rates increase for the non-tradable goods sector.

⁵³ The non-tradable goods sector is a low-skill intensive sector, thus the spending effect increases the relative demand for low-skilled workers, reducing the skill premium.

minimum wage, years of education, political stability, and financial crisis. More specifically, we highlight the impact that both trade openness and the specialization in “simple” products have had in reducing inequality.

As revealed in the models, an increase in trade openness of 1 percentage point results in a decrease between 0.02 and 0.05 points in Gini index. In all models, the variable is significant and shows a negative impact over income inequality. The models also demonstrate that the Economic Complexity Index is always significant and show that the “simplification” (as opposed to complexification) of the economy, following the process of trade openness, led to a reduction in income inequality in the 2000s in Latin America. Moreover, the results for the terms of trade and natural resources rents variables reinforce our conclusion regarding the impact of openness and “simplification”. The gains in terms of trade, as well as the increase in income associated with natural resources, explain the spending effect (Dutch disease) by which trade affects inequality.

With regard to the control variables, we highlight the results for GDP *per capita* (highly significant and negative, reinforcing the role of growth as a crucial factor for inequality reduction), and for the variables associated with the labour market (unemployment and real minimum wage – both highly significant and negative – suggesting that the Dutch disease directly affected the labour market).

Although effective in reducing inequality in the short term, in the face of a favourable external environment (*e.g.* increase in commodity prices) and other domestic conditions, the effects of Dutch disease may lead to de-industrialization, placing long-term risks for both economic growth and income distribution (Messina & Silva, 2017). From the policy-makers perspective, special attention should be given to the risks of concentrating production and exports in a few products with volatile prices such as commodities.

With regard to the limitations of this research, we can mention data limitations (absence of data for some countries and periods) and the level of detail of the econometric model (*e.g.* we did not test if structure of the series has been broken but introduce a dummy for the financial crisis period).

In future research, it would be important to further explore the relationship between international trade and inequality in different contexts and geographies. The study of this relation for groups of countries with different economic structures (*e.g.* rich/ poor in natural resources) in other geographies (*e.g.* Asia) for the same period could be enlightening. Another possible path would be to compare the impact of international trade over income inequality

in countries belonging/ not belonging to trade blocs. New studies could also be conducted to better understand the impact of international trade on geographical inequality within countries – specially for nations with large dimensions and big disparities (*e.g.* Brazil).

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Annexes

Annex 1 – Summary table: literature on international trade and income inequality.

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
Anderson (2005)	Openness and Inequality in Developing Countries: A Review of Theory and Recent Evidence	What are the links between openness and inequality in developing countries?	Qualitative (literature review)	<p>All (10) cross-country econometric studies compiled use data from both developed and developing countries; period: 1950-1995.</p> <p>Time-series empirical studies (13) for different regions: Latin America, Africa, and all regions.</p>	<p>Compiled studies use the following variables: openness (Sachs and Warner, 1995; trade–GDP ratio; measures of policy barriers to trade; capital controls; tariffs/ quotas on imports; import taxes-import value ratio; and membership of WTO)</p> <hr/> <p>Inequality (Gini and share of quintiles in national income)</p> <hr/> <p>Others (age structure of population, black market premium on exchange rate, capital per worker, education per worker, ethno-linguistic fragmentation, financial sector development, GDP pc, GDP per worker, government size (% of GDP), inflation, rule of law, arable land per capita, life expectancy, Gini coefficient of land holdings, political and civil liberties, real exchange rate, terms of trade, urban population (% of total)).</p> <hr/> <p>From 10 cross-country econometric studies and 24 variables analysed, 6 indicates a coefficient statistically significant and positive, 3 indicates a coefficient statistically significant and negative, and 12 indicates a coefficient is not statistically significant.</p>	<p>Most time-series studies find that greater openness has increased the relative demand for skilled labour, but most cross-country studies find that greater openness has had little impact on overall income inequality. One possible explanation is that countries selected for timeseries analysis are not representative of all developing countries. Another is that the effects of openness on income inequality via the relative demand for skilled labour have been offset by its effects via other channels.</p>

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
Beaton (2017)	Revisiting the Link between Trade, Growth and Inequality: Lessons for Latin America and the Caribbean	Does trade integration can promote economic growth without adversely affecting income inequality?	Quantitative (econometrics). Cross-country panel regressions and event studies.	Panel regressions: 118 countries; period: 5-year panels (1980-2013).	Trade Integration and Economic Growth (GDP, Labour force education, Terms of trade, Public Infrastructure, Trade openness, Foreign direct investment).	Effect of trade openness on inequality may vary with the level of development. Event studies confirm that countries in the process of liberalizing their trade do not observe worse dynamics in income inequality than the rest of the world. Trade openness can promote economic growth without adversely affecting income inequality.
				Event studies: 74 trade liberalization episodes; period: 1970-2001. Sources: Penn World Tables, World Bank, IMF, Observatory of Economic Complexity	Global Value Chains (Total GVC participation, Foreign value-added, Indirect value-added, Domestic value-added in intermediate goods production re-exported to third countries). Export Markets (Intra-regional exports, Exports to advanced economies, Concentration of trade with three largest trading partners, Export market diversification (HH index), Number of trading partners with a trade agreement). Export Products (Export quality, Export concentration index, Economic complexity index). Inequality (Gini, Share of agriculture/ services/ industry in value-added)	
Calderón & Chong (2001)	External sector and income inequality in interdependent economies using a dynamic panel data approach	Does the type of exports and the volume of trade affect the long run distribution of income?	Quantitative (econometrics).	102 countries; period: 5 years period averages (1960-1995). Source: IMF and Eurodollar London rate., Sachs and Warner (1995)	Openness (trade-GDP ratio) Inequality (Gini) Others (black market premium on exchange rate, education per worker, financial sector development, GDP pc, real exchange rate and terms of trade)	Importance of the type of exports to determine the impact of trade over income inequality. There is evidence of inequality reduction for developed countries (manufacturing exporters) and increase for developing countries (primary products exporters).
Quantitative				Nonproduction wage share		

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
Feenstra & Hanson (1996)	Globalization, Outsourcing, and Wage Inequality	Does outsourcing contribute to an increase in relative demand for skilled labour?	(econometrics).	1 country (United States); period: 1972-1994. Source: Census of Manufactures.	Outsourcing (share of imported intermediate inputs in the total purchase of non-energy materials)	Outsourcing has contributed substantially to the increase in the relative demand for non-production labour Outsourcing is positively correlated with the change in the relative employment of non-production workers, but weakly negatively correlated with the change in relative average annual earnings of nonproduction workers.
Fischer (2001)	The evolution of inequality after trade liberalization	What is the evolution of personal income distribution following trade liberalization?	Quantitative (econometrics).	66 countries; period: 5 years period averages (1965-1990). Source: UN National Accounts Statistics, Penn World Tables, World Bank, FAO.	Openness (Sachs and Warner, 1995) Inequality (Gini) Others (capital per worker, education per worker, and arable land per capita)	In the long-term, inequality depends simply on the effect of trade openness on interest rates. In the short-term, the type of the exported good, and the endowments associate to them, determines the effects of openness on inequality. In land (labour)-abundant countries, inequalities increase (decrease).
Goldberg & Pavcnik (2007)	Distributional Effects of Globalization in Developing Countries.	How globalization has affected income inequality in developing countries?	Qualitative (literature review)	Compiled (20) studies use a wide range of sources for globalization and inequality.	Compiled studies use the following variables: globalization (unilateral trade liberalization, removal of import licenses, FDI liberalization, trade liberalization, and outsourcing to China) Inequality (Gini, skill premium, wage (white/blue collar), and consumption inequality)	Evidence has provided little support for the conventional wisdom that trade openness in developing countries would favour the less fortunate. The particular mechanisms through which globalization affected inequality are country, time, and case specific.
Green <i>et al.</i> (2001)	A Picture of Wage Inequality and the	What was the impact of trade	Quantitative (econometrics)	350,000 individuals in about	Wage (level and dispersion of wages, skilled wage premium)	From 1992 onward there was a significant and substantial rise in the

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
	Allocation of Labour Through a Period of Trade Liberalization: The Case of Brazil	liberalization in Brazil over the labour market?		100,000 households in Brazil (household surveys); period: 1981-1999. Source: PNAD/ IBGE	Employment (employment composition before and after trade liberalization)	returns to college education. This coincided with the time when the trade reforms were beginning. After trade reform, there was a rise in the returns to college education which, since the share of college workers also rose, is attributable to rising demand. This change did not increase overall wage dispersion because of the small share of college-educated workers and because of decreasing returns to intermediate levels of education
Grossman & Rossi-Hansberg (2008)	Trading Tasks: A Simple Theory of Offshoring	How does offshoring (trading tasks) affect factor prices in the source country?	Theoretical modeling		The model developed considers three variables: productivity effect, relative-price effect, and labour-supply effect.	A decline in the cost of task trade directly boosts the productivity of the factor whose tasks become easier to move offshore. If the ensuing adjustment in relative prices is not too large or its impact on factor prices is not too powerful, all domestic parties can share in the gains from improved opportunities for offshoring. In contrast, several familiar trade theories predict an inevitable conflict of interests when the cost of trading goods falls.

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
Harisson <i>et al.</i> (2011)	Recent Perspectives on Trade and Inequality	What are the recent perspectives on trade and inequality?	Qualitative (literature review)	Number of studies published between 1990 and 2010 dealing with the connection between trade and inequality.	Three sets of variables are being incorporated into new trade models: (i) trade in tasks, model inaugurated by Feenstra & Hanson (1996) and revisited by Grossman & Rossi-Hansberg (2008); (ii) search frictions and unemployment, developed by Davidson <i>et al.</i> (1999) and revisited by Mitra & Ranjan (2010); and (iii) innovation, inaugurated by Dinopoulos & Segerstrom (1999) and further explored by Thoenig & Verdier (2003).	There are two main conclusions that have emerged from the theoretical literature: (i) offshoring can raise wage inequality in both countries, as in Feenstra & Hanson (1996), and, (ii), offshoring can raise the real wages of unskilled workers by enhancing their effective productivity, as in Grossman & Rossi-Hansberg (2008).
Hartmann <i>et al.</i> (2017)	Linking Economic Complexity, Institutions, and Income Inequality	Does a country's mix of products predict income inequality?	Quantitative (econometrics)	150 countries; period: 1963-2008. Sources: MIT's Observatory of Economic Complexity and U.N. Comtrade.	Economic Complexity Index (ECI): diversity of a country (number of products it exports), and the ubiquity of its products (number of countries that export that product). <hr/> Inequality (Gini) <hr/> Income (GDP pc) <hr/> Education (Years of schooling) <hr/> Institutions (Corruption control, Government effectiveness, Political stability, Regulatory quality, Rule of law, Voice and accountability) <hr/> Other (population)	Empirical results document a strong and robust correlation between ECI and income inequality. Countries exporting complex products have lower levels of income inequality than countries exporting simpler products.
Hausmann <i>et al.</i> (2007)	What you export matters.	Why do countries produce what they do, and does it matter?	Quantitative (econometrics)	113 countries and 5,000 products; period: 1992-2003. Source: U.N. Comtrade.	EXPY (income/productivity level that corresponds to a country's export basket) <hr/> PRODY (income/productivity level)	Countries that export goods associated with higher productivity levels grow more rapidly.

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
					Income (GDP pc) Others (human capital, capital-labour ratio, and rule of law index)	Not all good are alike in terms of their consequences for economic performance. Specializing in some products will bring higher growth than specializing in others
Isham <i>et al.</i> (2005)	The Varieties of Resource Experience: How Natural Resource Export Structures Affect the Political Economy of Economic Growth	How does natural resource export structures affect the political economy of economic growth?	Quantitative (econometric)	192 countries; period: 1974-1997 Source: UNCTAD, and World Bank	Natural resource endowment (Manufactures index, Diffuse index, Point source index, Coffee and cocoa index, ethnic fractionalization, predicted trade share, latitude, English language, European language, GDP pc, secondary school achievements, trade openness, change in terms of trade, share of primary exports/ GDP) Institutions (Rule of law, Political instability and violence, Government effectiveness, Control of corruption, Voice and accountability, Regulatory burden, Law and Order Tradition, Quality of the Bureaucracy, Political rights, Civil Liberties, Property rights and rule-based governance)	“Point source” and “coffee/cocoa exporting” countries do worse across an array of governance indicators. Countries with “point source” natural resource exports are doubly disadvantaged: are exposed to terms of trade shocks, and present lack of institutional capability for responding to shocks. This is not just a function of being a “natural resource” exporter, as countries with natural resource exports that are “diffuse” do not show the same strong differences.
Leamer <i>et al.</i> (1999)	Does natural resource abundance increase Latin American income inequality?	Why is income inequality higher in Latin America than in East Asia?	Quantitative (econometric)	87 countries; period: 1980-1990. Source: dataset used is available at www.personal.ander-son.ucla.edu/	Inequality (Gini) Net export structure Other (GDP per worker, secondary education per worker and economic distance)	Gini are related negatively to manufacturing and positively to basic extraction and tropical agriculture. Manufacturing sectors are positively correlated with secondary education.

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
				~peter.schott		<p>Countries that are rich in natural resources have one kind of product mix; countries that are scarce in natural resources have another mix.</p> <p>Countries with natural-resource-intensive sectors present delayed industrialization. Industrialization engenders greater equality (manufacturing requires accumulation of human capital).</p> <p>Greater income inequality is associated with the production of permanent crops and ores.</p>
Lundberg & Squire (2003)	The simultaneous evolution of growth and inequality	What policy-driven components of growth (greater openness, or greater government expenditure) might have an impact on inequality?	Quantitative (econometric)	<p>38 countries; period: 5 years period averages (1960-1994)</p> <p>Source: World Bank, Penn World Tables, IMF, Sachs and Warner (1995).</p>	<p>Openness (Sachs and Warner, 1995) and trade-GDP ratio)</p> <p>Inequality (Gini)</p> <p>Others (education per worker, financial sector development, GDP pc, government size (% of GDP), inflation, Gini coefficient of land holdings, political and civil liberties and terms of trade)</p>	<p>Coefficient is statistically significant and positive when using Sachs and Warner (1995) as measure for trade openness, but coefficient is not statistically significant when using trade-GDP ratio.</p> <p>Find no variables that robustly uniquely identify the determinants of growth or of distribution</p>
Meschi & Vivarelli (2009)	Trade and Income Inequality in Developing Countries	How does globalization is associated with narrowing or widening income disparities within developing countries?	Quantitative (econometric)	<p>65 developing countries; period: 1980-99).</p> <p>Sources: UTIP-UNIDO, IMF,</p>	<p>Inequality (EHII)</p> <p>Trade flows</p> <p>Human capital (ratio between the percentage of the population with basic education and the percentage of the population with no education)</p>	<p>Trade with high income countries worsen income distribution in DCs (only middle-income countries) through both imports and exports.</p>

Reference	Title	Research question	Research method	Sample	Variables	Main conclusions
				and World Bank.	Others (GDP pc and inflation rate)	Technological differentials and the skill biased nature of new technologies may be important factors in shaping the distributive effects of trade.
Messina & Silva (2017)	Wage Inequality in Latin America: Understanding the Past to Prepare for the Future.	Will the economic slowdown (started in 2011) put the brakes on the reduction of inequality in Latin America?	Quantitative (econometric)	This book summarizes the findings of a large research study, including 9 background papers. All papers have Latin American countries as sample, considered either as a group or individually. Papers consider data from the mid-1990s to 2014.	Papers consider mainly variables such as: inequality, employment, wages, trade and education.	Labour earnings are the main factor of general trends in income inequality in Latin America. In the 2000s, commodity boom led to exchange rate appreciation, falling interfirm wage disparities and consequently reduced wage inequality.
Pagés & Márquez (1998)	Trade and Employment: Evidence from Latin America and the Caribbean	What was the impact of trade liberalizations and economic reforms on employment?	Quantitative (econometric)	18 countries in Latin America and the Caribbean; period: 1970-1996 Sources: ECLAC, IDB, and ILO.	Openness (Trade flows, average tariffs, black market premia). Employment (Total employment, manufacturing employment, unemployment rates, total real wages)	Trade reforms have had a negative, albeit small, effect on employment growth, and that this effect has been reinforced by appreciation of the real exchange rate. Changes in domestic protection don't have an effect on unemployment, suggesting that movements in and out of the labour force dominate over flows into unemployment in the adjustment of the labour market.

Annex 2 – Determinants of the income inequality in Latin America, 1997-2016: Kuznets ratio.

Variables	Model 1'	Model 2'	Model 3'	Model 4'	Model 6'	Model 7'	Model 9'
Constant	3.581161 (0.0109) **	3.525576 (0.0112) **	1.927462 (0.0011) ***	8.633322 (0.0000) ***	5.312004 (0.0000) ***	1.643766 (0.0017) ***	6.078028 (0.0000) ***
Trade openness (% GDP)	-0.003239 (0.0256) **	-0.003084 (0.0274) **	-0.002662 (0.0593) *	-0.002817 (0.0120) **	-0.001693 (0.1180)	-0.003311 (0.0306) **	-0.001888 (0.1208)
Economic complexity index	---	0.264553 (0.0001) ***	0.263496 (0.0002) ***	0.237675 (0.0000) ***	0.204363 (0.0002) ***	---	0.064728 (0.0369) **
Net barter terms of trade	---	---	-0.000819 (0.0802) **	---	---	---	0.000764 (0.1248)
Natural resources rents (% of GDP)	---	---	---	0.001236 (0.7866)	---	---	-0.001206 (0.8181)
Log GDP per capita	-0.112341 (0.4590)	-0.101276 (0.5024)	0.082504 (0.6649)	-0.667082 (0.0000) ***	-0.320263 (0.0001) ***	0.092668 (0.5724)	-0.277680 (0.0285) **
Unemployment	---	---	---	---	0.024429 (0.0000) ***	---	0.020204 (0.0207) **
Employment in industry (% of total employment)	---	---	---	---	---	---	0.000240 (0.9757)
Real minimum wage (average annual index)	---	---	---	---	---	---	-0.001430 (0.0014) ***
Average years of education	---	---	---	---	---	---	-0.133394 (0.0067) ***
WGI: Political Stability	---	---	---	---	---	-0.151453 (0.0051) ***	-0.019973 (0.6521)
Financial crisis (dummy)	---	---	---	---	-0.156767 (0.0000) ***	---	---
Model Summary							
R-squared	0.811255	0.824124	0.827194	0.598032	0.664469	0.830478	0.655896
Adjusted R-squared	0.779798	0.793801	0.796397	0.591161	0.657269	0.799480	0.637880
F-statistic	25.78897	27.17786	26.85942	87.03393	92.28429	26.79106	36.40643
Prob (F-statistic)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Durbin-Watson stat	1.049352	1.167349	1.165608	1.010949	1.088013	0.836057	0.804693
Observations	239	239	239	239	239	208	202
Number of countries	14	14	14	14	14	14	14

Notes: (1) Significance level at 1% (***), 5% (**) and 10% (*); p-value in parenthesis.

(2) Models 1', 2', 3' and 7' are estimated controlling for cross-section and period fixed effects. Models 4', 6' and 9' are estimated using random effects. All models use the White (diagonal) as coefficient covariance method for heteroskedasticity correction.

Annex 3 – Table: specification and diagnostic tests (Kuznets ratio).

	Model 1'	Model 2'	Model 3'	Model 4'	Model 6'	Model 7'	Model 9'
Hausman test – cross-section	0.0000	0.0000	0.0000	0.2487	0.9261	0.0002	0.3775
Hausman test – period	0.0000	0.0000	0.0000	0.0000	0.0757	0.0000	0.0011
Redundant fixed effect – cross-section	0.0000	0.0000	0.0000	---	---	0.0000	---
Redundant fixed effect – period	0.0216	0.0097	0.0013	---	---	0.0568	---
Redundant fixed effect – cross-section/period	0.0000	0.0000	0.0000	---	---	0.0000	---

Notes: p-values reported in table.